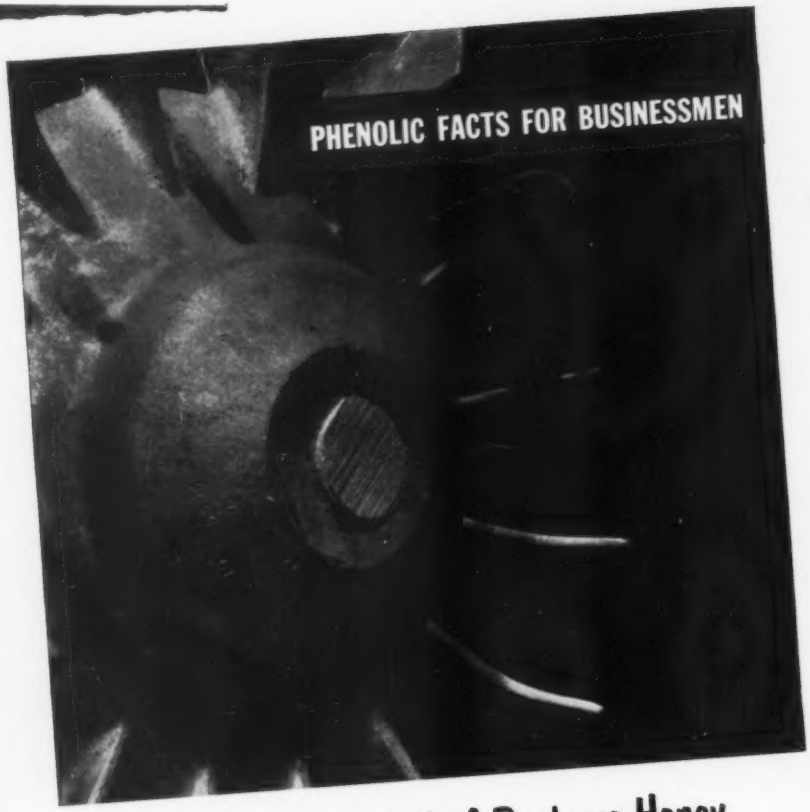
MODERN PLASTICS

DECEMBER 1953

HOW the Corvette BODY is Built —— Page 83

RIGID Vinyl can be INJECTION Molded —— Page 113



Metal Blossom full of Business Honey

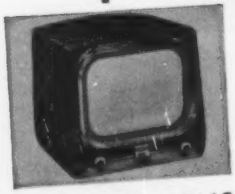
● We mean *money*. For the manufacturer who ordered it and the foundry that cast it...and for *any* company that seizes the advantages available in the new shell mold method of producing ferrous and non-ferrous metal castings.

The advantages include surfaces almost pattern-smooth . . . castings conforming to tolerances as small as .003 per inch . . . machining minimized and in some cases eliminated . . . greater uniformity, hence fewer rejects . . . summing up to lower finished unit cost.

With shell molding success depending largely on sand-bonding-resin, Durez has developed special foundry resins of high uniformity that facilitate mass production. These resins make it easier to obtain castings with desired qualities of structure, dimensional accuracy, and finish.

In other fields too . . . rubber, abrasives, paper products, wood waste utilization, and molding plastics to name a few . . . new Durez phenolic developments have made progress faster. Let us tell you more about the properties of these materials and how *you* may use them profitably. Durez Plastics & Chemicals, Inc., 1212 Walck Road, North Tonawanda, New York.

DUREZ

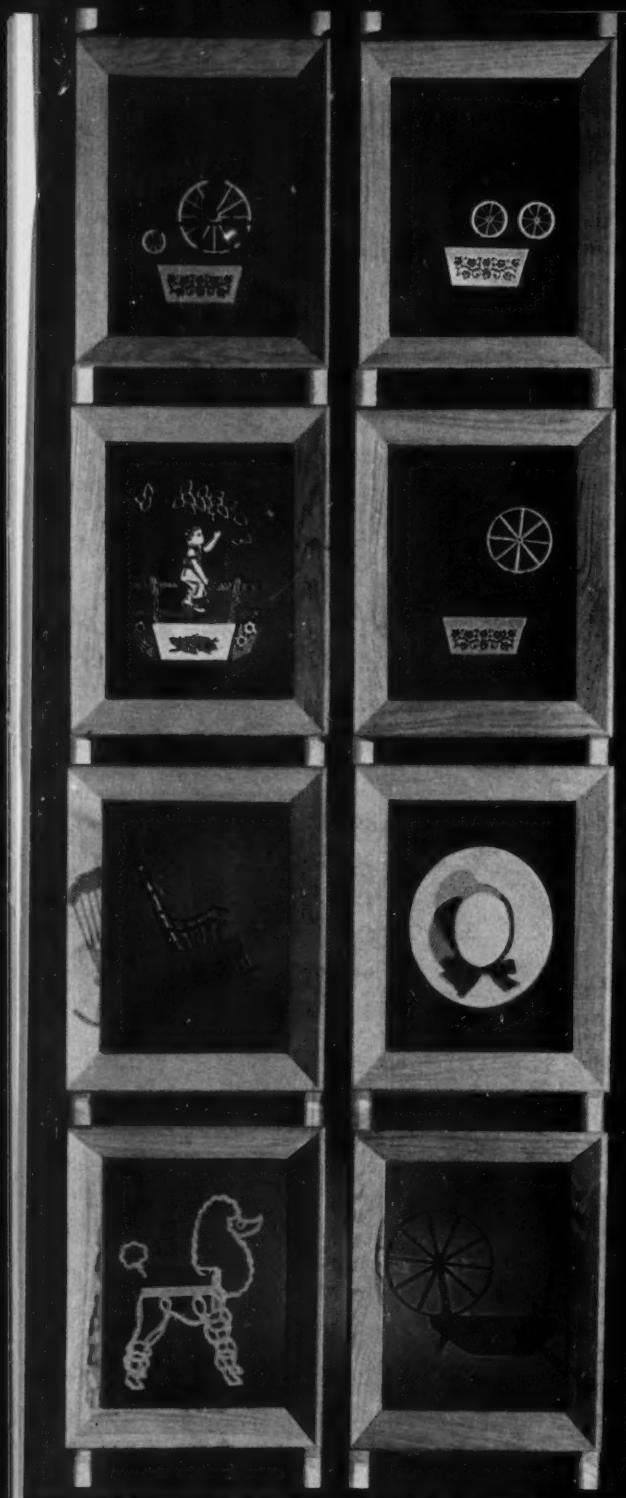


MOLDING COMPOUNDS
Structural, Electrical and Chemical Properties in Many Combinations

●

RESINS FOR INDUSTRY
Bonding, Casting, Coating, Laminating, Impregnating, and Shell Molding

PHENOLIC PLASTICS THAT FIT THE JOB



This season young plants are sunning in stunning planters* – molded of

CATALIN

Styrene

Bernard Edward Company fetchingly frames their freshness in nostalgic turn-of-the-century motifs!

Ideas for dressing up nature's young growths are beginning to sprout blossoms! In the hands of imaginative designers, and with CATALIN STYRENE, the gem of plastics, as the molding material—floral planters share the seat in a model phaeton . . . go for a ride on a high bike . . . recline in a rocker . . . pick cherries . . . attend the spinning wheel . . . walk the poodle . . . and don a be-ribboned straw sailor!

The colors, the retention of fine detail, and the delicacy of the silhouetting creditably reflect upon the mold-ability of CATALIN STYRENE . . . and though but a few ounces of the plastic are represented in any one subject—each, presents itself as a light, yet strong, generously sized, popularly priced creation—into which plant life can be stylishly rooted and readily watered.

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**Products of Bernard Edward Company 5252 So. Kolmar Ave., Chicago 32, Ill.*

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CATALIN CORPORATION OF AMERICA

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In addition to Styrene Molding Compounds, Catalin's chemical family includes a wide range of Urea, Phenolic, Cresylic, Resorcinal, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

December 1953 • Vol. 31, No. 4

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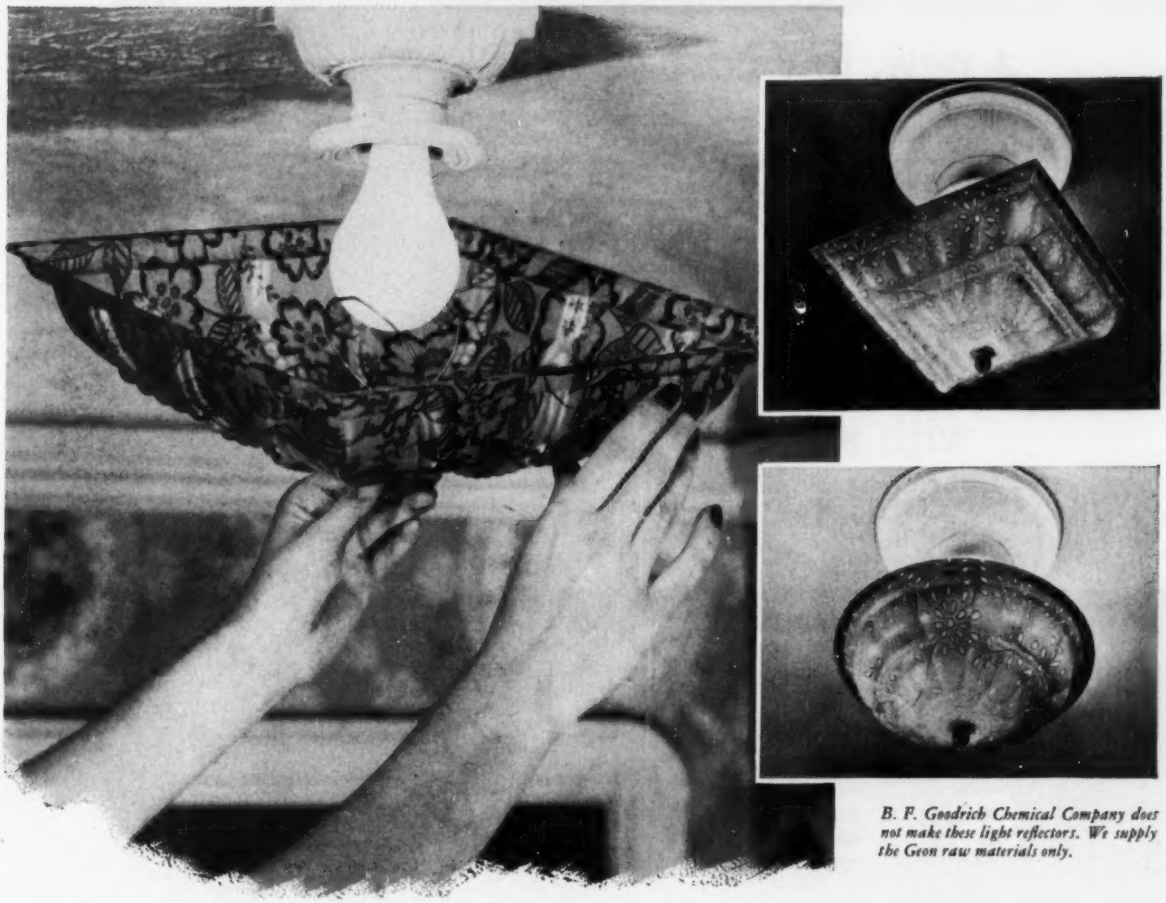
B. F. Goodrich Chemical *raw materials*



B. F. Goodrich Chemical Company does not make these light reflectors. We supply the Geon raw materials only.

UNsmashable idea... smash hit in sales!

TAKE the advantages of a new material — add imagination — and the pay-off is sales!

For example, a manufacturer got interested in rigid Geon polyvinyl plastic, the tough material with dozens of uses. He quickly saw how it could be used for a translucent light reflector with improved light dispersion and, best of all, non-smashable. Several designs shown here are standard equipment in mass housing projects. Obviously other markets will welcome the idea.

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- LARGE AREA PARTS AT LOW COST

CAMPCO DIVISION of

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EDITORIAL

A Good Year—Another Ahead

This issue closes out a most eventful year in plastics and a year in which worthwhile production and marketing trends were furthered.

The revolution in plastics product and component design is notable. Only two years ago the attitude of designers toward plastics was based largely on a consideration of plastics as replacement for other materials, and metal and wood traditions were a stymie to progress. Today's concept of product design for plastics involves the negation of tradition and an open-mindedness that is already creating bigger markets for plastics.

The trend toward industrial-proprietary plastics products and materials was firmly established during the past year. Plastics pipe and fittings, extruded sheets for vacuum forming, plastics structural panels, printed circuit materials, and standardized coil forms are but a few of the products emphasized in this trend.

Public relations of the industry for its materials and products has never been better at industrial, marketing, and consumer levels. Public knowledge of plastics has increased greatly this year. Public interest in plastics from a standpoint of investment has also increased favorably. And the work being done on standards by the various industry divisions has contributed immeasurably to this excellent public relations condition.

In many fields new opportunities are about to be opened to plastics, particularly with the development of alloyed materials and automatic machinery, and the acceptance of new forms of energy.

The coming year should find not a few plastics processing plants converted to automation, should find a great increase in the use of electronics, ultrasonics, and nucleonics for processing, should find stable standards for industrial-proprietary materials, should find wholly new products designed for maximum and optimum use of plastics, should find public interest and appreciation keeping pace with plastics developments.

A wide advance in the use of plastics industrial resins, a broadening of applications and facilities for vacuum forming, a big increase in the use of reinforced plastics, new developments in all kinds of laminates, and new additions to the industrial-proprietary field are on the horizon.

Business climate for 1954 looks reasonably fair and, cost-consciousness in industry being most serious because of competition, plastics will have better opportunities than ever before.

And the fact that the industry has achieved new organizational strength and has acquired a new and wholesomely cooperative attitude on such matters as standards should help us reach new heights.

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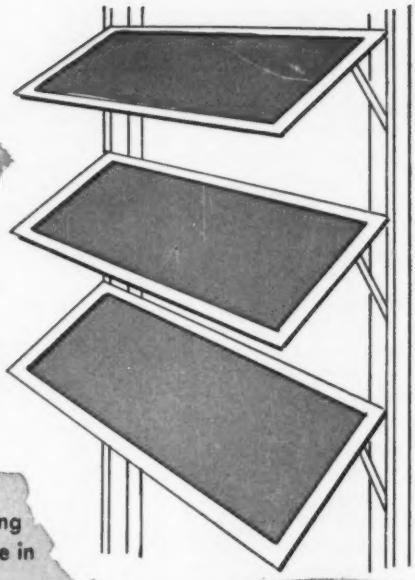
...the Scientific Approach to Controlled Sunlight



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This is a brand new approach to light control by which you can actually put light into its place. In fact, it is even more astounding because it is the first time that this system has ever been accomplished. Smartly installed, it completely eliminates the use of mechanical devices such as venetian blinds, awnings, glare deflectors and shades. Installed in awning-type windows for example, it serves as an awning when opened, a venetian blind opened or closed, a glare deflector by inbuilt characteristic and a shade at all times.

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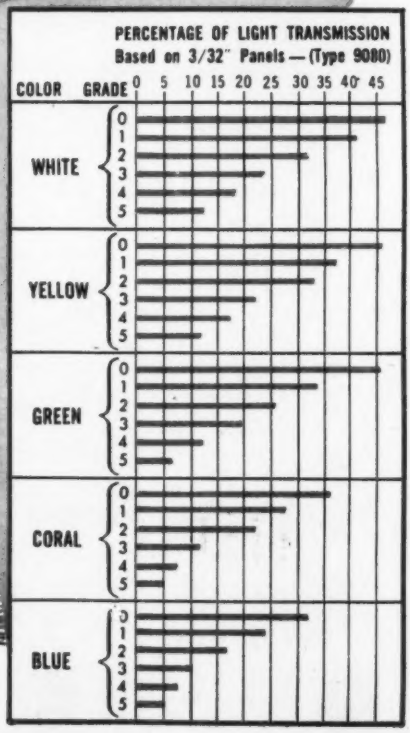
Explore the possibilities of GRADATION *TROPIGLAS* for use in new and modernized buildings.



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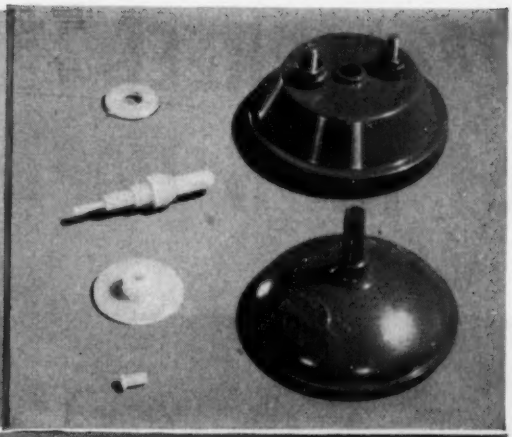

...help automatic starter withstand vibration, give long, trouble-free service

Why not investigate how this unique engineering material—DU PONT NYLON —can help improve your product?

These six parts, as used in a new starter developed for automatic transmission cars, demonstrate how the unique properties of Du Pont nylon can help engineers develop more efficient products.

Du Pont nylon is strong and durable. Parts made of it withstand shock and vibration. Nylon can't corrode, is unaffected by most common chemicals. Du Pont nylon is light in weight, heat-resistant and remarkably resilient. Parts resist wear and abrasion, provide quiet operation with little or no lubrication. And Du Pont nylon's electrical insulating properties insure positive operation.

Perhaps the valuable properties of Du Pont nylon can help you develop a new or improved product or process. For further information on Du Pont nylon write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 3012, Du Pont Bldg., Wilmington 98, Delaware.

Check all these outstanding properties of Du Pont nylon—

- √ **TOUGHNESS**—Nylon is virtually unbreakable, even at low temperatures.
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Nylon parts molded by United Plastics Industries, Inc., Vassar, Mich., for Automo Corp., Saginaw, Mich.

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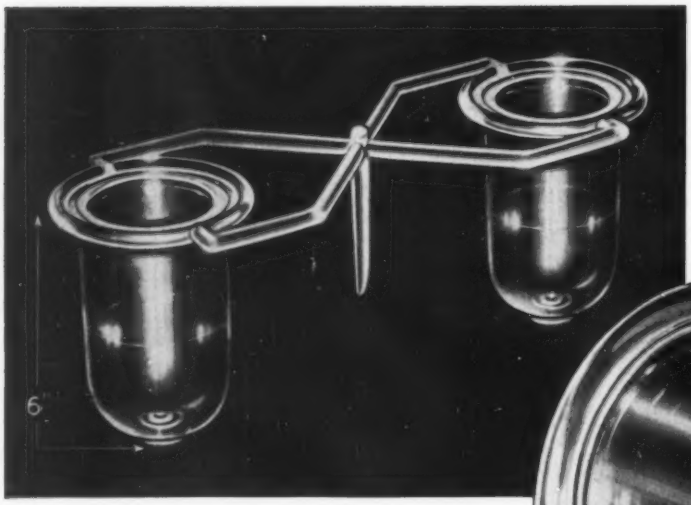


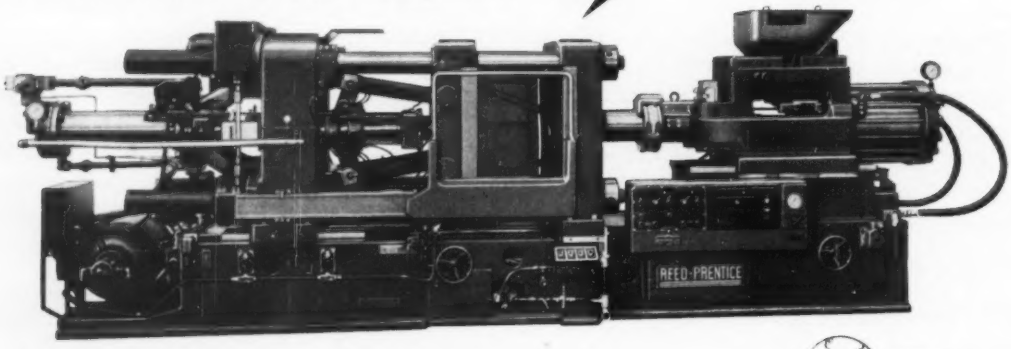
● Confronted with molding a 28 oz. "shot" of high-impact Bakelite C-11 material, Birmingham Plastics, Inc.* confidently put it on their Reed-Prentice 600T-24 oz. injection machine.

Their confidence was well justified. The 24 oz. "Reed" readily handles the job, producing two strong, durable filter bowls on each cycle. Birmingham Plastics molds the ¼" thick bowls for Master Pneumatic Supply Company of Detroit.

*Birmingham, Michigan

This fine molding job is typical of the many tough ones for which molders rely on extra-capacity "Reeds" — available in 4, 6, 8, 12, 16, 20, 24, 32, 48 and 200 oz. capacities.

You can expect even greater results from this improved Reed-Prentice 600T-32 oz. Injection Molding Machine



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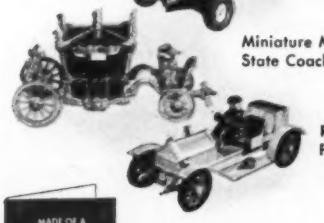
Why is Celanese* Acetate the big news in toys this year?

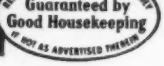
Plakie infant toys

Saunders Stock Car, Hot Rod

Miniature Masterpiece State Coach



Revell Highway Pioneer model car



Daisy Play Guns

The toys that sell best today have one thing in common—toughness.

Customers are demanding durable toys with long play-life . . . insisting on lasting quality no matter what the price bracket. That's why more and more of the leading toy manufacturers are meeting this demand with Celanese acetate.

Daisy Play Guns have stocks made of acetate. Saunders wheel toys, Revell scale models, Miniature Masterpieces, and Plakie infant toys keep out in front with acetate—the plastic that resists jagged edged breaks.

Some plastics talk tough but, remember, acetate is tough. And that's what makes big news in toys this year. For complete information, write Celanese Corporation of America, Sheet and Molding Compound Department 101-L, 290 Ferry Street, Newark 5, New Jersey.

Canadian affiliate, Canadian Chemical Company, Ltd., Montreal and Toronto.

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tough acetate plastics

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One OPERATION . . . *More* PROFIT . . . *Less* TROUBLE!

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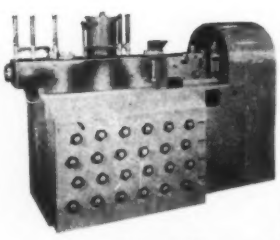
America's leaders in the plastic field recognize the superiority of Welding Engineers exclusive design dual worm equipment and are constantly expanding their Welding Engineers installations. They KNOW the value and blaze the way—toward bigger profits and less headaches for YOU!



COMPOUNDING: Welding Engineers equipment is successfully blending copolymers, mixing rubber and resins, and incorporating colorants in a wide variety of hard-to-handle material. **EXTRACTING:** Removal of large amounts of moisture from G.R.S. and other synthetic materials, monomer removal and other difficult extraction jobs are "naturals" for Welding Engineers equipment. **EXTRUDING** material into pellets, strands, shaped strips through the necessary dies is performed in one operation following the custom-fitted dual worm compounding.

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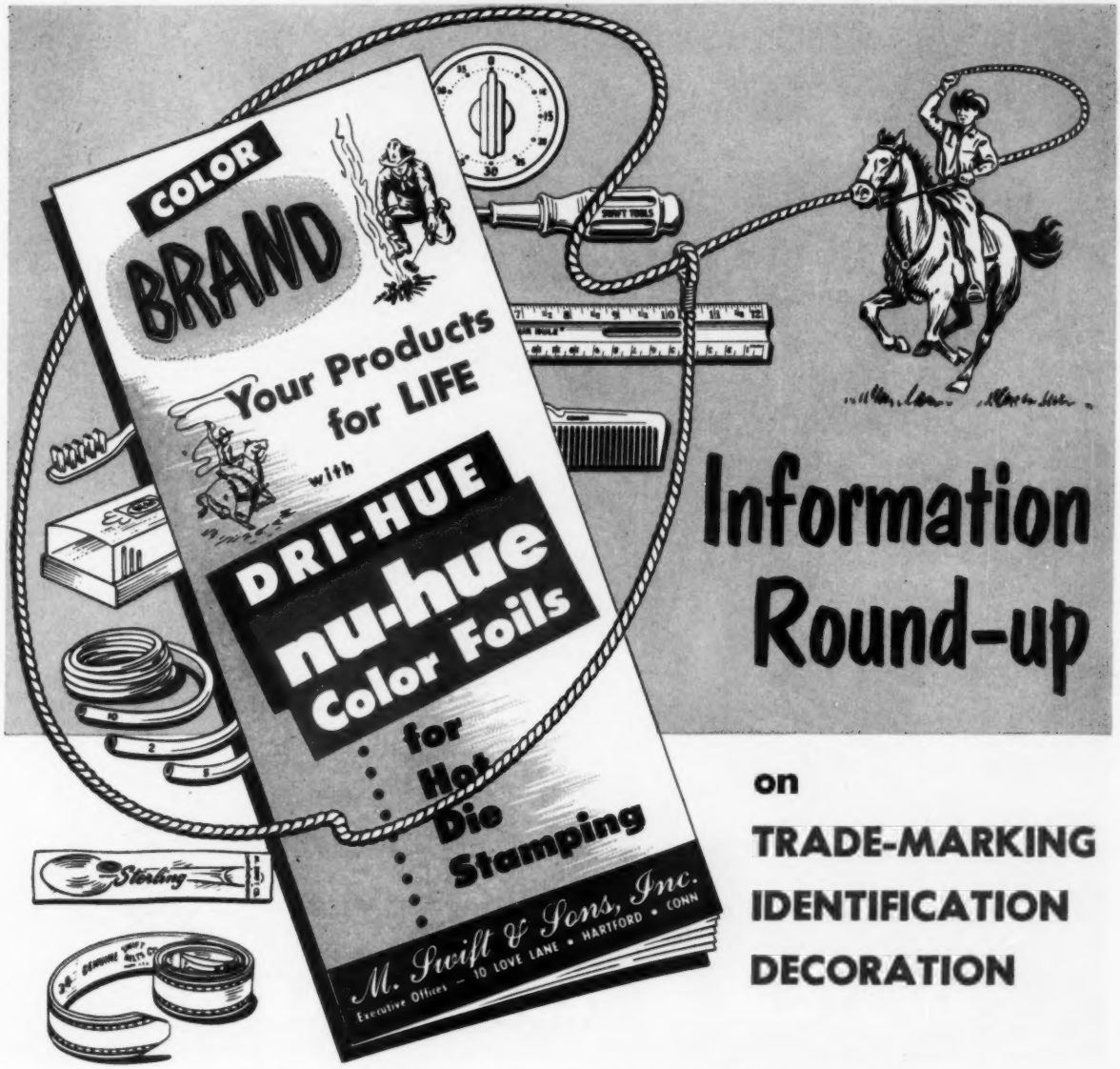

Information Round-up

on TRADE-MARKING IDENTIFICATION DECORATION

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Ranges don't have to be beautiful in order to be efficient—but they do have to be beautiful in order to attract buyers in a highly competitive market. Plastics lend themselves admirably to the achievement of decorative utility, and ERIE, pioneer in custom molded plastics, is a natural choice of many leading manufacturers as a source of dependable supply.

ERIE plastics are used for control panels and for translucent knobs which reveal at a glance which switches are on. They are used for name plates and trademarks in three-dimensional plastics to give proud identification with jewel-bright beauty that enhances the value of the product.

Write for your copy of bulletin,
"Who We Are . . . What We Do in Plastics"

25th Anniversary ERIE TRADE MARK

ERIE RESISTOR CORPORATION . . . PLASTICS DIVISION

Main Offices: **ERIE, PA.**

Sales Offices: Cliffside, N. J. • Philadelphia, Pa. • Buffalo, N. Y. • Chicago, Ill. Detroit, Mich. • Cincinnati, Ohio • Los Angeles, Calif.

Factories: **ERIE, PA.** • **LONDON, ENGLAND** • **TORONTO, CANADA**

Can you name 33 topflight resin manufacturers?

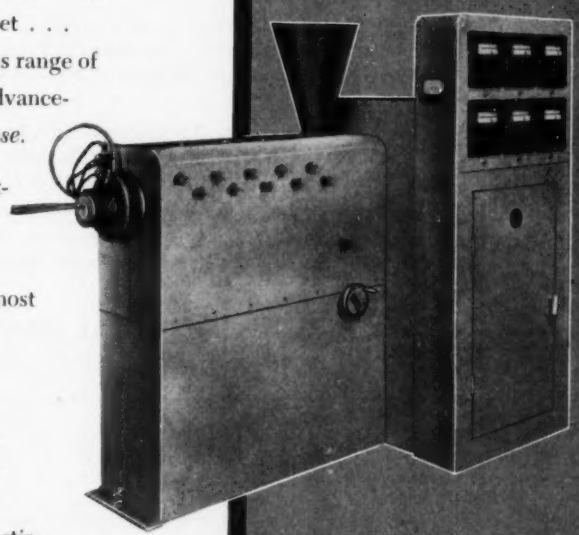
We can... because they all have purchased MPM extruders!

Take the common thermoplastics—polyethylene, styrene, vinyl chloride, cellulose acetate; take the uncommon ones—vinyl formal, vinyl butyral, the fluorothenes; take those that are still being put through their paces in the laboratories and that haven't even been named yet . . . and you will begin to get an idea of the enormous range of materials that are being extruded on the same advance-design MPM extruders you can buy for *your own use.*

As a direct outgrowth of MPM's superior heating and cooling system, temperature control, screw speed control, and corrosion-resistant construction, thirty-three of the country's foremost manufacturers of thermoplastics have chosen them for *their own use.*

What do they use them for? For spot-checking current production; for color blending; for development work on behalf of their customers; for extruding experimental thermoplastic compounds.

The very fact that MPM extruders are so popular with so many resin suppliers is conclusive proof that they rate "tops" for versatility and reliable performance. We will gladly send you details. Write today.



This is the world-famous MPM 2½" extruder

modern plastic machinery corp. mpm

15 Union St., Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

West Coast Representative:
4113 W. Jefferson St., Los Angeles 16, Calif.

now Firestone service pictures your processing needs

based on the high processing speed and wide versatility of

905 — 915 — 925 EXON

With Firestone service, you can chart many a processing problem to a quick solution.

At right for example, you can see on Firestone's 3-dimensional chart why your operating temperature need never hinder your ingenuity or product progress.

For any given plasticizer loading, use this chart to determine the proper ratio of EXON resins for *your* operating conditions.

It was to serve you in solving many of your production problems that Firestone created the three new, fast-fusing polyvinyl chloride resins, EXON 905, 915, 925. These temperature-tailored resins offer several unique advantages. Among them are:

- **Extremely rapid blending...hot or cold.**
- **Shorter fusing time...for a faster, more economical operation.**
- **Freedom from fisheyes...assuring higher quality, greater product uniformity.**

When you come up against a processing problem, team Firestone service with Firestone's versatile resins...and let them help you open new horizons for your equipment.

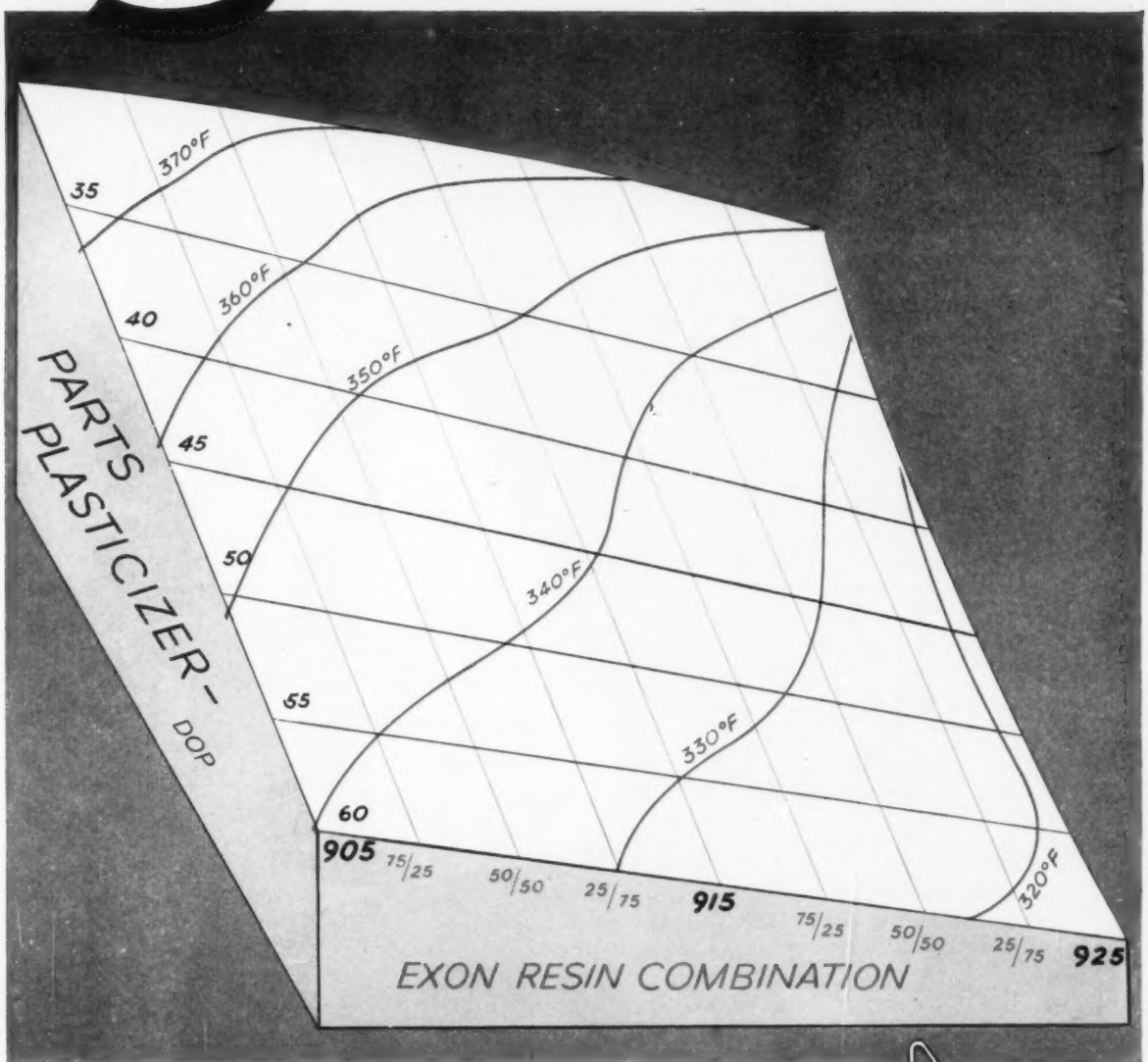
PHYSICAL PROPERTIES

	FORM	SPECIFIC GRAVITY	AVERAGE RELATIVE VISCOSITY	AVERAGE BULKING DENSITY
EXON 905 Excellent for film and sheeting applications where higher temperatures (up to 375° F.) are called for.	White Powder	1.40	2.50	0.45
EXON 915 High-versatility, resin specially designed for sheeting. Wide range of operating temperatures.	White Powder	1.40	2.30	0.45
EXON 925 An excellent P. V. C. resin for low processing temperatures. (starting at 275° F.)	White Powder	1.40	2.05	0.45

For further information on Firestone's complete line of high quality EXON resins...or for the assistance of Firestone's Technical Service, call or write:

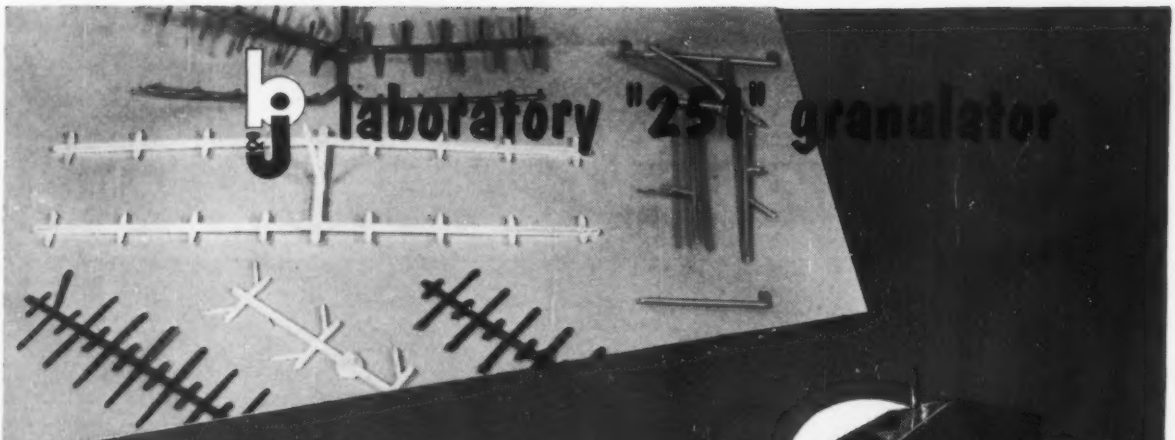
CHEMICAL SALES DIVISION
FIRESTONE PLASTICS COMPANY · POTTSTOWN, PA., DEPT. 19B
Division of Firestone Tire and Rubber Co.

...in 3 dimensions!



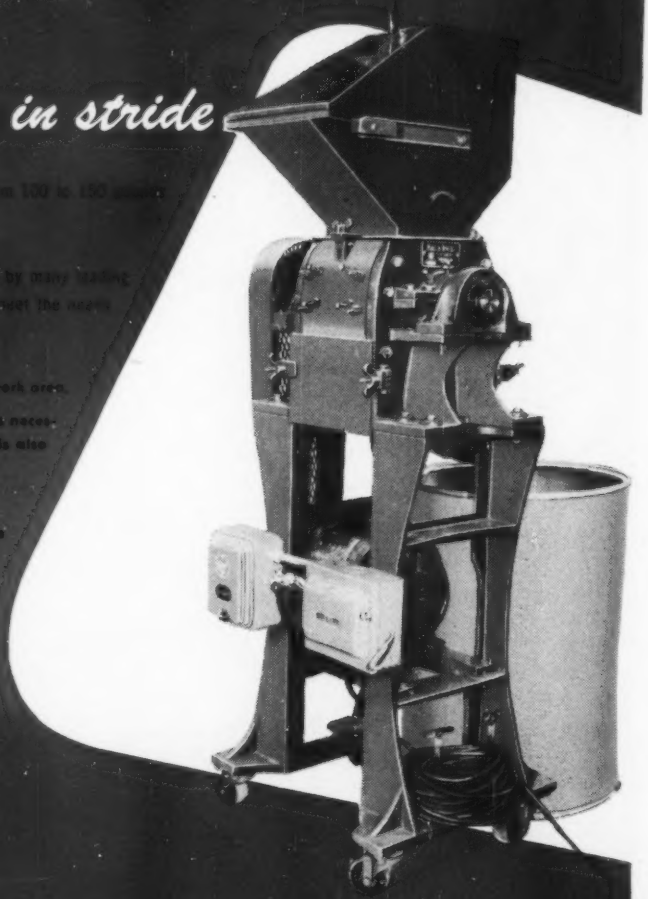
IN ORDER to determine quickly and easily the proper combination of EXON resins best suited to *your* processing conditions, just consult the handy chart above.

Follow the black line indicating Parts Plasticizer to the intersection of your Operating Temperature indicated by the red line. Carry this point parallel to the green guide lines down to the EXON Resin Combination at the bottom of the graph.



B & J Laboratory "251" granulator

Takes scrap like this in stride



For grinding sprues, runners and small rejects at capacities from 100 to 150 pounds an hour, you can't beat the B & J Laboratory "251".

The features you'll find in the "251" have been recommended by many leading molders — to provide the maximum in operating efficiency — to meet the needs of practically every plant. For instance:

THE "251" TAKES LESS FLOOR SPACE . . . gives you more work area.

GRANULATES DIRECTLY INTO ANY DRUM . . . eliminates the necessity of transferring material from bin to drum. The "251" is also available with a bin receptacle.

NEW HOPPER DESIGN . . . prevents fly-back leakage.

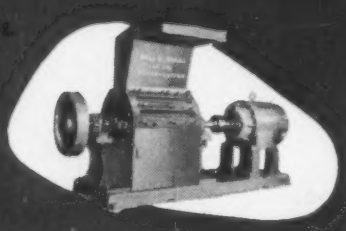
LARGE THROAT OPENING . . . the 8" x 8" throat is more than adequate for gates, sprues and rejects.

EASY ACCESSIBILITY TO ALL PARTS . . . hopper, screen and chute or bin are all removed quickly and easily for cleaning.

WITH OR WITHOUT CASTERS . . . for portability.

The Laboratory "251", like all machines in the B & J line, is chock-full of extra features. To aid you in choice of granulators, send for our general bulletin.

For high production grinding, the B & J No. 1½. Capacity up to 1200 pounds an hour. 20 or 25 H.P. motor.



WHICH GRANULATOR IS BEST FOR YOU?

Send samples of your material for grinding in the fully equipped B & J Testing Laboratory — we will recommend the machine best suited to the material and your capacity requirements. No obligation, of course.

REMEMBER, ONLY B & J MAKES A COMPLETE LINE OF GRINDERS

BALL & JEWELL, INC.

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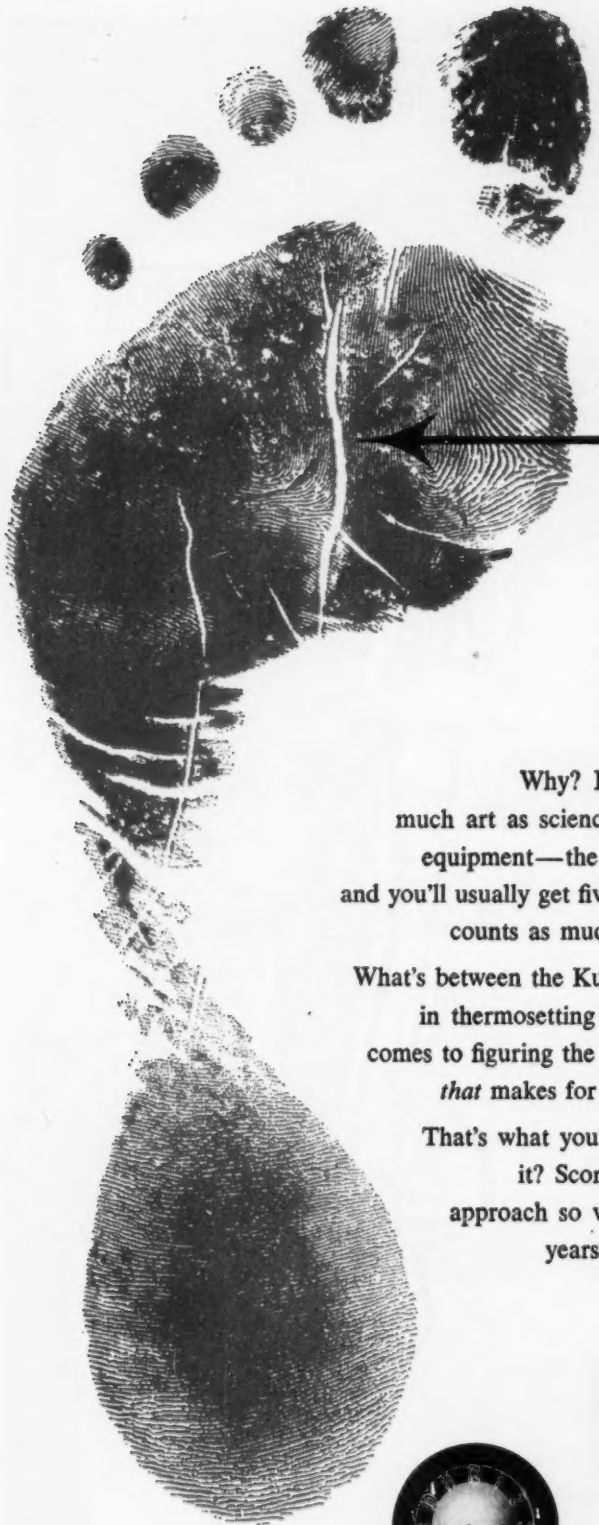


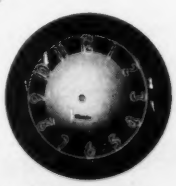
In Plastics

This is what a Moulding Job is Absolutely As Individual As

Why? It's an unusual business, moulding plastics—still as much art as science. Give five custom moulders the same presses and equipment—the same material sources—the same set of drawings—and you'll usually get five sets of results. What's between your moulder's ears counts as much—but varies as much—as what's at his fingertips.

What's between the Kurz-Kasch corporate ears is 37 years of specialization in thermosetting moulding. That makes for some orneriness when it comes to figuring the best and least expensive way to tackle your job. But *that* makes for most pleasing results in quality, price and deliveries.

That's what you're paying your money for, isn't it? Are you getting it? Scores of firms, large and small, like our individualistic approach so well that we've handled their moulding for over ten years! Why not you?



Urea clock case, 1-piece compression-moulded, for Westclox —a 10-year-plus KK customer.

KURZ-KASCH

Specialists in Therms-Setting Plastics for 37 years

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, Lexington 2-6677 • Rochester, Hillside 4352 • Chicago, Merrimac 7-1830 • Detroit, Trinity 3-7050 • Philadelphia, Hilltop 6-6472 • Dallas, Logan 5234 • Los Angeles, Richmond 7-5381 • St. Louis, Delmar 9577 • Toronto, Riverdale 3511

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ON THE AIR

"The Big Give Away"

"Good morning, Purchasing Agents everywhere! This is your old pal 'Smiley' Hotshot welcoming you to the *Plastics Quiz* brought to you 365 days a year by courtesy of the Friendly Molding Co. Yes, Purchasing Agents, there are big prizes for everyone. Free inserts. Low cost molding powders. Molds at half-price. Deliveries twice as fast as you can get any place else.

"Just see your Friendly Molding Co. salesman for complete details. He'll be calling on *you*—to save you lots and lots of that old cash—some day real soon. Etc. Etc. Etc. Etc. . . . ."

O. K., Mr. P. A. Would you buy moldings from this guy's sponsor?

Boonton doubts it. This custom molding business isn't a radio quiz program subsidized by a wealthy soap tycoon. Aside from a few sharp operators, it's a business known for producing quality moldings at fair prices. So it's a good idea to step cautiously when you tangle with a molder who operates "The Big Give-Away."

For more than thirty years, Boonton has been numbered with the country's fine reliable producers of custom injection and compression moldings . . . and we're proud of it! You won't find us offering you something for nothing. We have to get paid for what we do if we're going to be around to do more molding next year. So does any molder who is worth his salt.

Live dangerously, if you prefer to, Mr. Purchasing Agent. But you'll live longer and more happily if you order your moldings from Boonton.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

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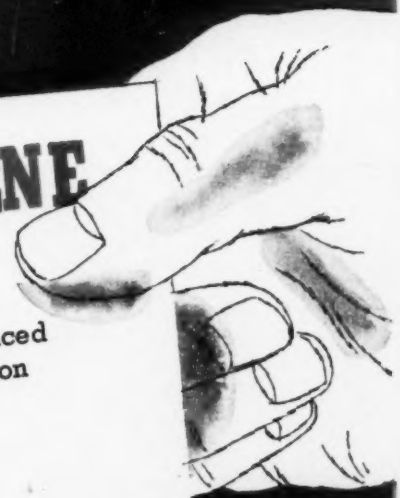
As exclusive distributors for Fostarene—Muehlstein offers you a dependable source for quality Virgin Polystyrene. Our experienced technicians and nation-wide sales organization stand ready to serve you.



MUEHLSTEIN

REPROCESSED PLASTICS

If you sell plastic scrap . . . use reprocessed plastics or have your scrap reprocessed—look to Muehlstein for reliable service. Our complete laboratory facilities and technical staff assure satisfaction, especially with color problems.

H. MUEHLSTEIN & CO. INC.

60 EAST 42nd STREET, NEW YORK 17, N. Y.

BRANCH OFFICES: Akron • Chicago • Boston • Los Angeles • Memphis
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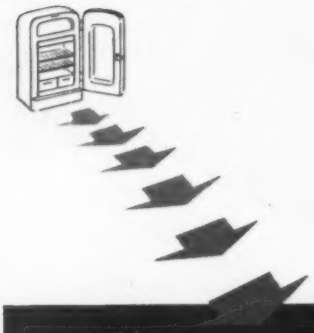

Odor-free, mirror-smooth glass laminates

molded with ATLAC 382

You can produce glass-reinforced pieces that are as odor-free and virtually as smooth as glass itself—by using Atlac 382 dry powder polyester resin.

No "after-styrene" smell: Atlac 382 is completely devoid of odor after curing. This quality makes it especially applicable to products such as refrigerator linings, food containers and tote boxes where odor contamination may be objectionable.

Smoother finish: Atlac 382 gives a glass-like finish free of the usual rough appearance and feel of surface fibers, because it does not shrink away from the mold upon curing. It produces an ideal surface for painting.

Atlac 382 is a dry powder, readily mixed in styrene. It never cures in storage. It's always fresh . . . always cures the same. It flows freely into complex molds.

For full data, write or call Atlas today.

Other ATLAC Polyester Resins

ATLAC LV—for low-viscosity laminating solutions in room temperature or matched metal die molding applications.

ATLAC 363—high-solubility binder for mat production.

ATLAC 370—low-solubility binder for mat and preform production.

ATLAC FP—flame-resistant polyester.

ATLAC FLX—flexible type polyester supplied in liquid form.

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ATLAS POWDER COMPANY, CANADA, LTD.
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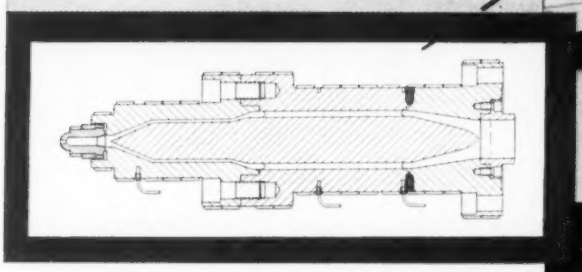
IT'S RED HOT

H-P-M's NEW HEATING CHAMBER

INCREASES PLASTICIZING CAPACITY 100%



NEW HEATING CHAMBER DESIGN now standard on all H-P-M 9, 16, 32 and 60 oz. plastics injection molding machines.

40% SAVINGS IN CYCLE—Example: A 7½ oz. shot, formerly molded on a 12 oz. competitive machine in 37 seconds, is now molded in H-P-M's new 9 oz. in just 23 seconds . . . a 14 seconds saving per shot.

HOW ABOUT WALL TILE? Example: H-P-M's 16 oz. with new heater is producing tile (4½"x4½"x.065" thick) in an 8-cavity mold on an 18-second floor to floor cycle!

QUICK COLOR CHANGE—Example: When molding cellulose acetate, the new H-P-M 9 oz. requires only 7 lbs. material to change from flesh color to white!

EASIER MOLD FILLING—Example: In testing new molds, a 48-cavity doll arm mold was filled in first shot with H-P-M's new 9 oz.

- 3-zone heat control with concentration of high-wattage heaters at chamber entrance.
- Heat is applied directly to spreader, eliminating air gaps and resultant heat loss.
- Narrow, high-temperature heating bands, with stainless steel clamps, provide excellent contact with chamber.
- High efficiency of new chamber lowers heat requirements approximately 100° F. and injection pressures reduced as much as 3000 P.S.I. on the material.
- New chamber is ideally suited for all modern thermoplastic materials — including flexible vinyl.
- Chamber is easily dismantled for cleaning.
- Improved terminal block — mounted directly on chamber —eliminates need for long wire leads.
- H-P-M's threadless, quick-change nozzle tip can't break off in the chamber!

WRITE FOR FULL DETAILS TODAY!

HPM

THE HYDRAULIC PRESS MFG. COMPANY

1010 Marion Road, Mount Gilead, Ohio, U. S. A.

PRESSES FOR EVERY PRESSURE PROCESSING APPLICATION

Another Sound Example

of combinations in plastic and metal by Santay for RCA

A REVOLUTIONARY NEW AIRCRAFT MICROPHONE THAT ELIMINATES ALL SOUND INTERFERENCE

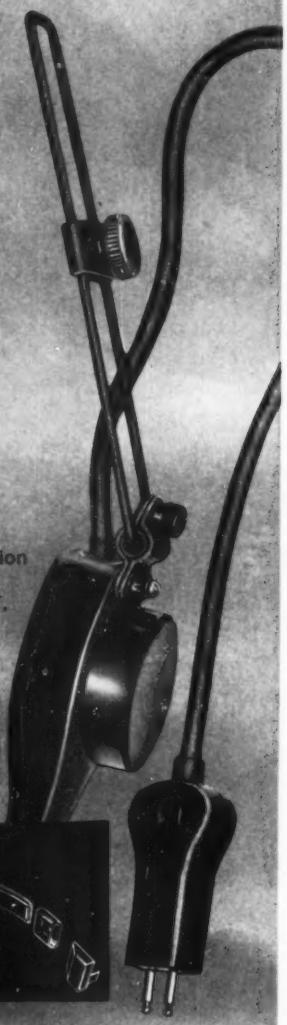
This is a BOOM MIC, developed by RCA for use in Jet and other high speed airplanes where engine operating noise always interferes with voice transmission. By means of an intricate balancing motor, the BOOM MIC filters away all sound disturbances and transmits only the pilot's voice . . . his landing instructions . . . his call for help . . . those few but vital words that mean safety.

Human lives depend upon this product. There is no room for carelessness. There can be no mistakes. Knowing this, RCA calls upon SANTAY for all plastic and metal components. The BOOM MIC was originally designed as a three piece body to be cemented together. SANTAY engineered a one piece body using a 3" radius curved core pull to make the internal channel. With great skill, they mold the boom and cover from nylon, the tip from polyethylene and supply all metal parts . . . a combined operation under one roof which permits rigidly controlled quality standards and offers the greatest efficiency possible. Another sound example of a sound product by SANTAY.

Write today for new full color book, "Precision Manufacturing." It's yours free . . . with no obligation.

Santay

Santay Corp., 355 N. Crawford Ave., Chicago 24, Ill. SAcramento 2-2900



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801 Bird Avenue, Buffalo, N. Y.

INJECTION MOLDING • METAL STAMPING • ELECTRO-MECHANICAL ASSEMBLIES

The Crow and the Pitcher

A Crow, ready to die with thirst, flew with joy to a pitcher which he beheld some distance away. But when he came up to it, he found the water so low that with all his stooping and straining he was unable to reach it. Thereupon he tried to overturn the pitcher, so that at least he might be able to get a little of it. But his strength was not sufficient for this. At last, seeing some pebbles near by, he cast them one by one into the pitcher; and thus, by degrees, raised the water up to the very brim and satisfied his thirst.—*Aesop*

PLENCO PHENOLICS

FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Skill and patience will prevail. Look to Plenco for the skill and patience it takes to produce quality controlled Phenolics suitable to almost any application.

PRODUCTION RATE

100" or more per minute

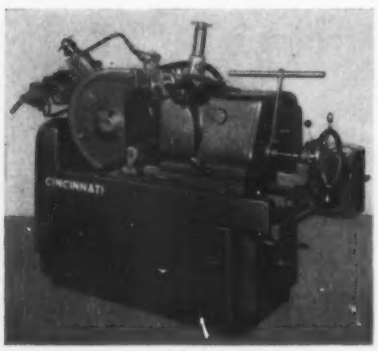
centerless grinding plastic tubes and rods on a cincinnati filmatic

Grinding plastic tubes on a CINCINNATI FILMATIC No. 2 Centerless Grinder, at a production rate of well over 100" per minute. Stock removal .050" to .075".

Because of its speed and accuracy, the centerless method is ideal for rapid, precision grinding operations on plastic and ceramic parts. Electrical insulators, glass bottle stoppers, pump packing rings, fountain pen parts, plastic tubes and rods, and others are being ground at extremely rapid rates of production on CINCINNATI FILMATIC Centerless Grinders. The illustration shows how plastic tubes and rods are ground at a rate of 100" per minute. ¶ Many features give CINCINNATI FILMATIC Centerless Grinders a low-cost rating for work of this type. FILMATIC grinding wheel spindle bearings run for years without adjustment or maintenance; lubrication is automatic; electrical control equipment is built-in. And to top it off, Cincinnati Application Engineers can give you the benefit of twenty-seven years' experience in centerless work. They'll be glad to help you with your high priority production problems.

CINCINNATI GRINDERS INCORPORATED
(Subsidiary of The Cincinnati Milling Machine Co.)
CINCINNATI 9, OHIO

P.S.—If you're not familiar with the centerless method of grinding, write for booklet, "Principles of Centerless Grinding," No. G-503-2.



CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Catalog No. G-611-1 contains complete specifications. For a brief description of the centerless machines, look in Sweet's Machine Tool Catalog.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

BLACK PICTURE of product failure is this badly discolored vinyl upholstery trim. You can stop such degradation from the start by using heat- and light-resistant PLIOVIC.

LONGER PRODUCT LIFE

—at lower cost, comes with PLIOVIC

BIG, built-in advantage of PLIOVIC—Goodyear's easy-processing, polyvinyl chloride resin—is its exceptional heat and light stability.

This unusual resistance of PLIOVIC to degradation spells longer life at lower cost for your product. You can use less stabilizer. You can use cheaper stabilizers. You can formulate simpler compounds easier. And you can do this with less danger of product failure.

The added stability of PLIOVIC also permits greater latitude in processing time and temperature, full development of product color and safe re-use of scrap and tailings.

Exceptional stability, ease of processing and excellent physical properties are just some of the reasons for using PLIOVIC in your product. The full story—in the form of a new, technical manual—is yours simply by writing to: Goodyear, Chemical Division, Akron 16, Ohio

We think you'll like "THE GREATEST STORY EVER TOLD"
every Sunday—ABC Radio Network
THE GOODYEAR TELEVISION PLAYHOUSE
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Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use-Proved Products—CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS—The Finest Chemicals for Industry

THE DOWDING

Injection Moulding Machine

Fully Automatic Fast-Cycling

UP TO 1,200 CYCLES PER HOUR

FAST PLASTICIZING

AUTOMATIC LUBRICATION

BRITISH MADE

SPECIFICATION

APPROXIMATE WEIGHT OF MATERIAL PLASTICIZED PER HOUR (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2·074 sq. in.
Pressure per square inch on material at end of plunger ...	9,100 lb.
Total pressure on Injection plunger	18,850 lb.
Mould opens (adjustable)	6-9 in.
Maximum die space	7½ in.
Minimum die space	3½ in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	16 x 10 in.

EARLY DELIVERY

DOWDING & DOLL LTD

346 KENSINGTON HIGH STREET, LONDON, ENGLAND. *Grams:* ACCURATOOL HAMMER LONDON

NEWS

FOR SUB-ASSEMBLY MANUFACTURERS

New potting material provides air-tight seal and great mechanical strength for circuits containing delicate components

EPON® RESIN

gives you 5 basic advantages

1. Outstanding adhesion . . . provides a moisture-proof, vibration-proof, metal-to-metal or metal-to-glass bond. Epon resin keeps its remarkable adhesion even during a solder bath . . . ideal for potting and embedding miniature components.

2. High resistance to mechanical and thermal shock . . . permits rapid cycling between −90°F and +400°F without cracking or deforming. Even *delicate* tube assemblies can take rough usage and high operating temperatures without damage.

3. High dielectric strength... even under extreme conditions of temperature and humidity.

4. Exceptional dimensional stability . . . Epon resins set quickly with unusually low shrinkage and maintain this dimensional stability over wide temperature variations.

5. Easy to use . . . Epon resins can be cast at relatively low temperatures. Complete cures can be obtained at 150°F in less than 2 hours.

Write for information on the use of Epon resins in electrical and electronic applications.

SHELL CHEMICAL CORPORATION

CHEMICAL PARTNER OF INDUSTRY AND AGRICULTURE

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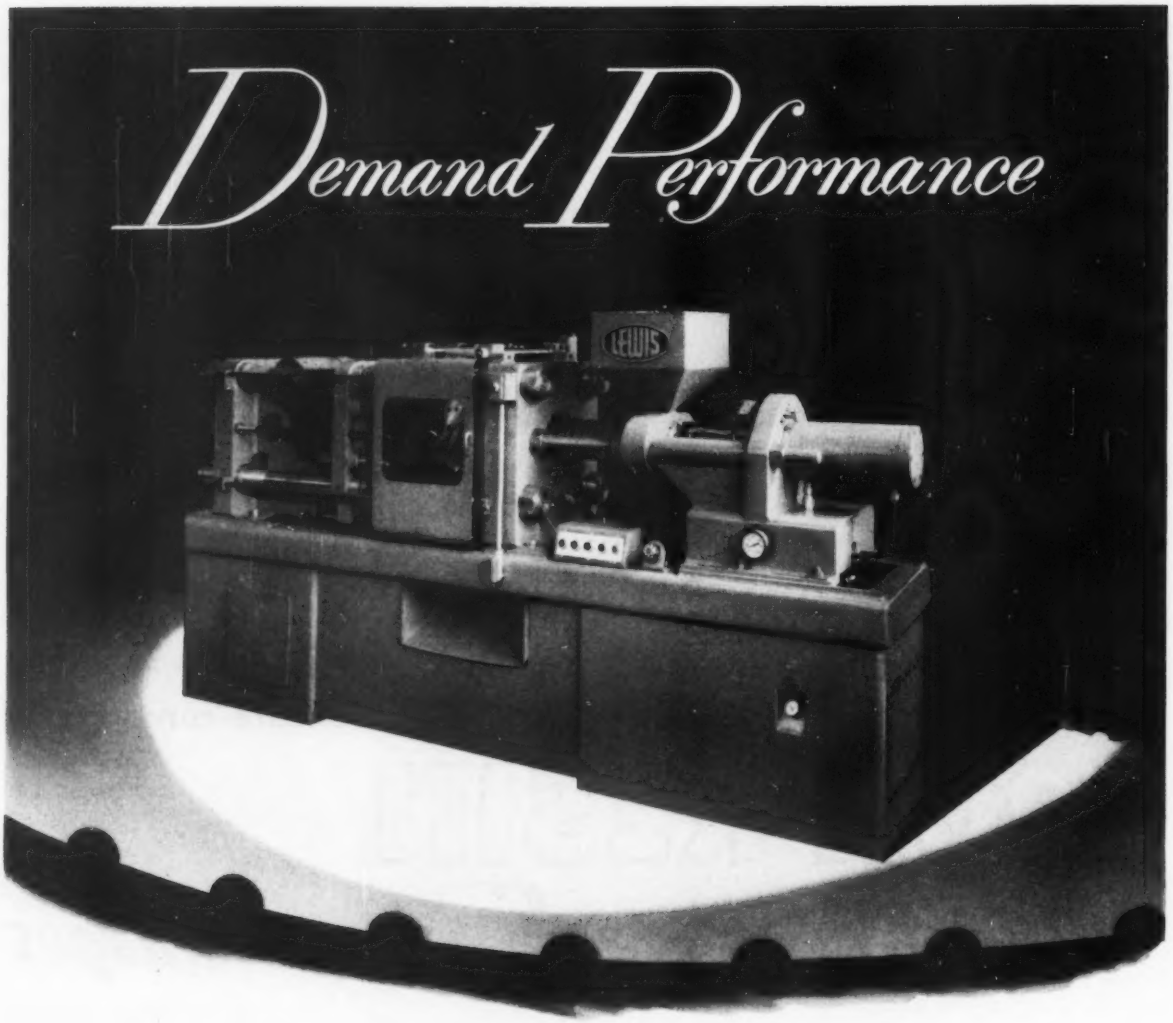
Demand Performance



Featuring the Lewis "6" Injection Molding Machine

The LEWIS Model "6" has been designed to meet injection molders' specific demands for greater economy . . . versatility . . . speed . . . and safety. This new machine can do the work of much larger units at a fraction of their initial and normal operating costs. Engineered to produce a wide variety of large projected area parts, Model "6" will plasticize up to 60 pounds of material per hour . . . mold 7-ounce shots of polystyrene at the rate of 2½ per minute.

An exclusive feature of the LEWIS "6" is the new HYDRA-LOCK clamp . . . the safest, most powerful mold clamping mechanism available today. HYDRA-LOCK utilizes only a cupful of oil to develop a 200-ton clamping pressure in tenths of a second. In addition, its design facilitates quicker, easier mold setting procedures.

For that all-important competitive advantage of high-speed low-cost production . . . specify the LEWIS "6" injection molding machine. It's engineered for demand performance.

1570-LW

Write for Bulletin 102 for complete details.

LEWIS

The Lewis Welding and Engineering Corporation

11 INTERSTATE STREET • BEDFORD, OHIO

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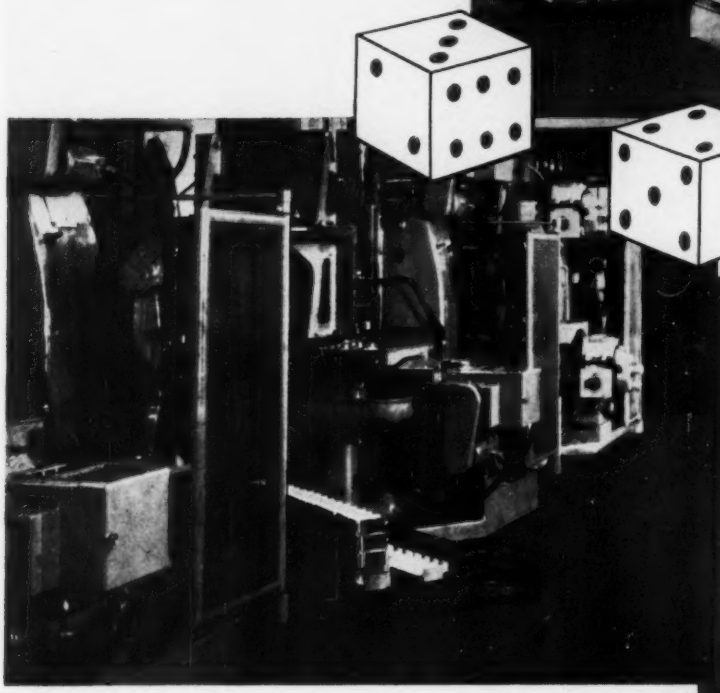
N. J. OUELLETTE, LEOMINSTER, MASS. • VINMONT AND CO., NEW YORK CITY • MOORE MACHINERY CO., LOS ANGELES, SAN JOSE, SAN FRANCISCO

a natural...



for prompt service on precision molds

from your master patterns

Clark-Aiken makes available to you the most complete facilities for production of precision duplicate molds to be found anywhere, including:

1 Single-Spindle Keller, 8 ft. x 3 ft. capacity, 3-Dimensional
1 Single-Spindle Keller, 4 ft. x 2 ft. capacity, 3-Dimensional
1 Single-Spindle Keller Profiler, 24 in. x 16 in. capacity
2 Single-Spindle Kellers, 36 in. x 20 in. cap., 3-Dimensional
2 3-Spindle Kellers, 36 in. x 10 in. center distance, 3-Dimen.

7 **NEW AC-TYPE ELECTRICALLY-CONTROLLED CONTOUR MILLING MACHINES** manned by master craftsmen working three shifts, insure prompt delivery of precision duplicate molds in any quantity from master patterns of any material.

Send prints or sample parts for prompt quotations and delivery dates

PRECISION MOLD DIVISION

Clark-Aiken COMPANY

LEE, MASSACHUSETTS

Baldwin Presses provide the uniform temperatures needed to keep LAMICOID® quality high . . .

THE PROBLEM:

In manufacturing Lamicoid as a carefully controlled high quality product, Mica Insulator Co., Schenectady, required presses which would enable them to maintain precise temperatures during the curing cycle.

THE BALDWIN SOLUTION:

Mica reports that Baldwin presses have provided consistently the uniform heat and pressure which cure uniformly, prevent warping and avoid discoloring of laminated sheets. A further benefit to Mica is the fact that their seven Baldwin presses, in operation for seven to eighteen years, have been exceptionally free of maintenance problems and costs.

Papers and cloths of all types (including asbestos and glass cloths), impregnated with thermo-setting synthetic resins, are cut to size and stacked in layers to produce the desired thickness. These stacks are then placed in hydraulic presses like this Baldwin for final cure. The various grades and types of Lamicoid are cured at varying pressures and temperatures ranging up to 1,200 pounds per square inch and approximately 350° F. for varying lengths of time.

What's your pressing problem?

No matter what your needs might be, Baldwin can help you promptly by analyzing your problem and recommending the standard or special Baldwin press for laminating or moulding plastics or rubber. For full details about the full line of Baldwin steam platen and compacting presses, please write for Bulletins 185 and 186 to Dept. 4526, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN · BLH · LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

For Longer WEAR and

LONGER

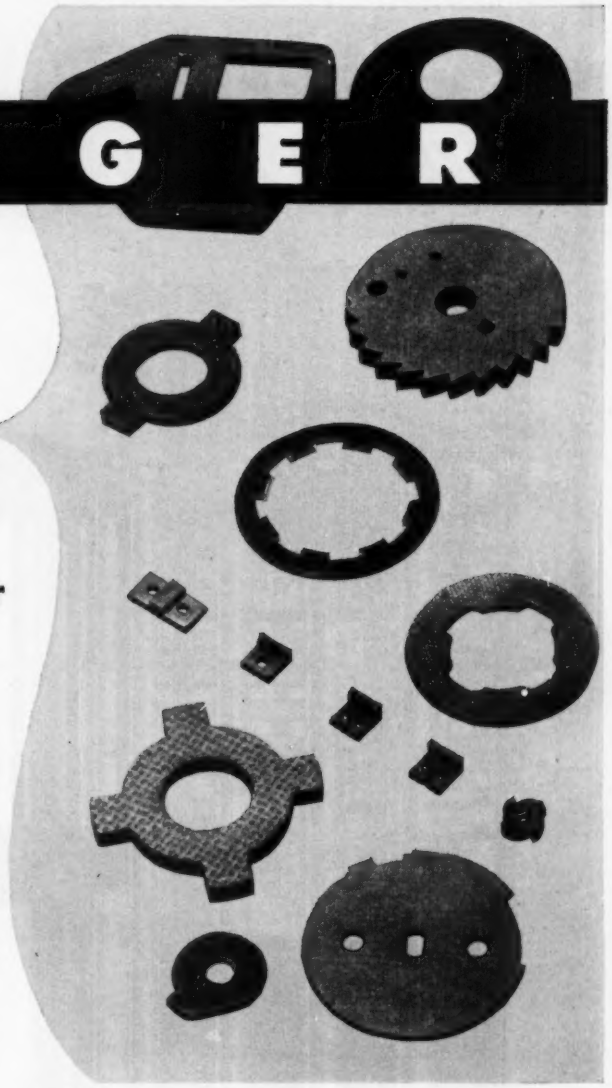
SERVICE LIFE

SPECIFY

Spaulding

PRODUCTS

for parts subject to wear



Components fabricated by Spaulding to your specifications from Spaulding basic materials offer great ***resistance to wear*** in a wide variety of combinations with such other properties as structural strength, dimensional stability, light weight, electrical insulation, moisture resistance, resistance to chemicals, clean machining, and quietness in mechanical operation.

When designing a new product or improving an existing one, ask you nearest Spaulding Branch Office for a recommendation as to the correct types and grades of Spaulding materials that will give it better service characteristics. Ask also for full information on how you can reduce costs by utilizing Spaulding's complete fabricating facilities.

SPAULDING FIBRE COMPANY, INC., TONAWANDA, NEW YORK

MAKERS AND FABRICATORS OF:

VULCANIZED FIBRE: In sheets, rods, tubes and fabricated parts.
ARMITE: Thin Insulation (Fish Paper) in sheets, rolls, coils and fabricated parts.
SPAULDITE: (Laminated Phenolic Plastic) in sheets, rods, tubes and fabricated parts.
SPAULDO: Motor Insulation in sheets, rolls, coils, slot cells and other fabricated parts.
SPAULDING FIBRE BOARD: In sheets and fabricated parts.
SPAULDING T BOARD: A superior Transformer Board, in sheets and fabricated parts.
MATERIALS HANDLING EQUIPMENT: Factory trucks, Boxes, Barrels, Trays, etc.

SPAULDING FABRICATING FACILITIES

Spaulding's fabricating facilities for these products are unsurpassed the world over. You can save time and money by letting us do your fabrication. We'll be glad to quote on specific jobs without obligation to you.

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CHICAGO 38, ILL.
5604 West 63rd St.
CLEVELAND 14, OHIO
2108 Payne Ave.
CLEVELAND 16, OHIO
19035 Detroit Rd.
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DAYTON 2, OHIO
136 South Ludlow St.
DETROIT 1, MICH.
4612 Woodward Ave.
FORT WAYNE 6, IND.
2301 Fairfield Ave.
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2021 South Cedar St.
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MILWAUKEE 8, WIS.
3329 West Vliet St.
NEW YORK 55, N. Y.
384 East 149th St.
NEWARK 2, N. J.
965 Broad St.
PHILADELPHIA, PA.
702 Federal St.
Camden 3, N. J.
ST. LOUIS 5, MO.
34 North Brentwood Blvd.
TONAWANDA, N. Y.
310 Wheeler St.
LOS ANGELES 15, CALIF.
C. D. LaMoree
1325 San Julian St.
BERKELEY 10, CALIF.
C. D. LaMoree
2221 Fourth St.
TORONTO 18, ONT., CANADA
A. A. Andersen & Co.
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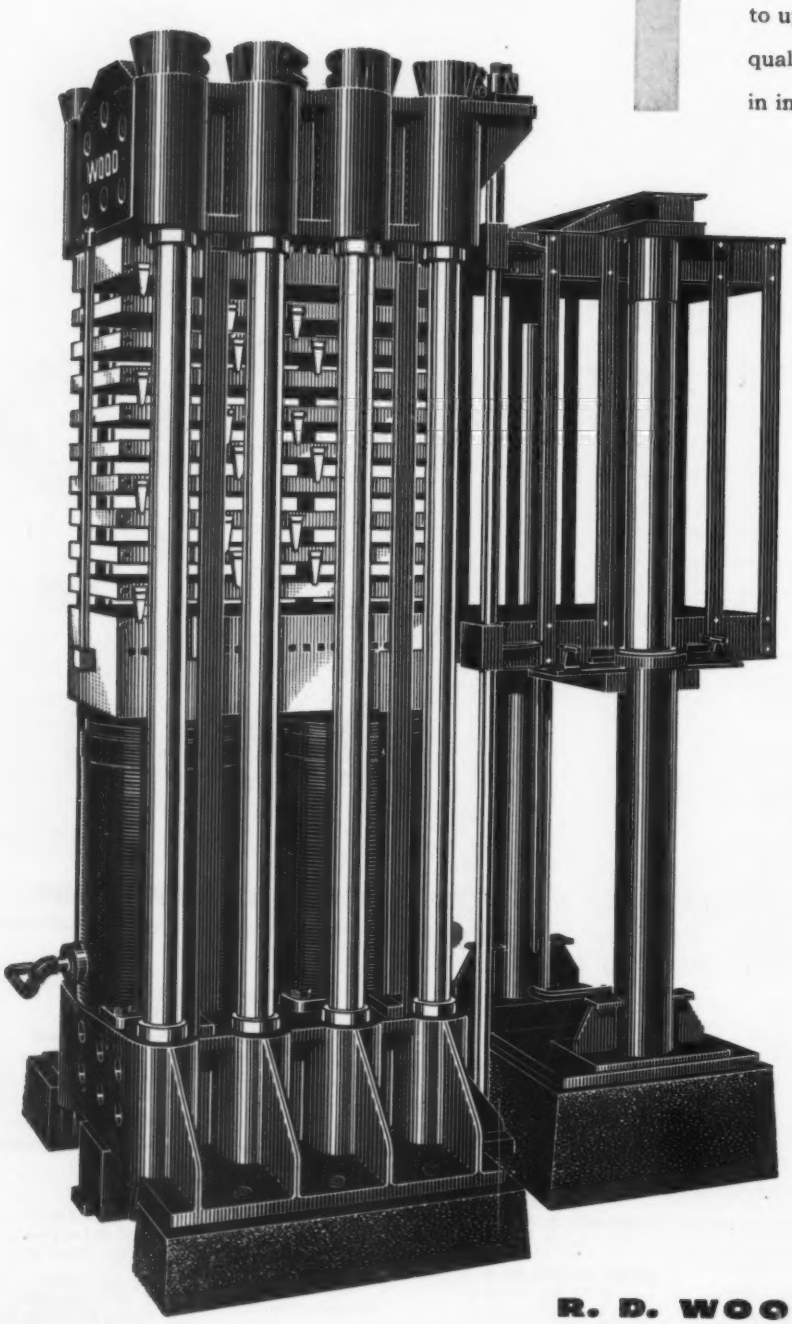
R.D. Wood Hydraulic Presses

"... that industrial equipment which has maintained high excellence in manufacture will continue to be sold, and will contribute its worth to uplifting the general quality of everything produced in industrial America ..."



2,700-ton capacity ten opening hydraulic steam platen press designed for laminating, curing and polishing plastic sheets to uniform thickness. *Write for catalogs of our hydraulic presses.*

150th anniversary

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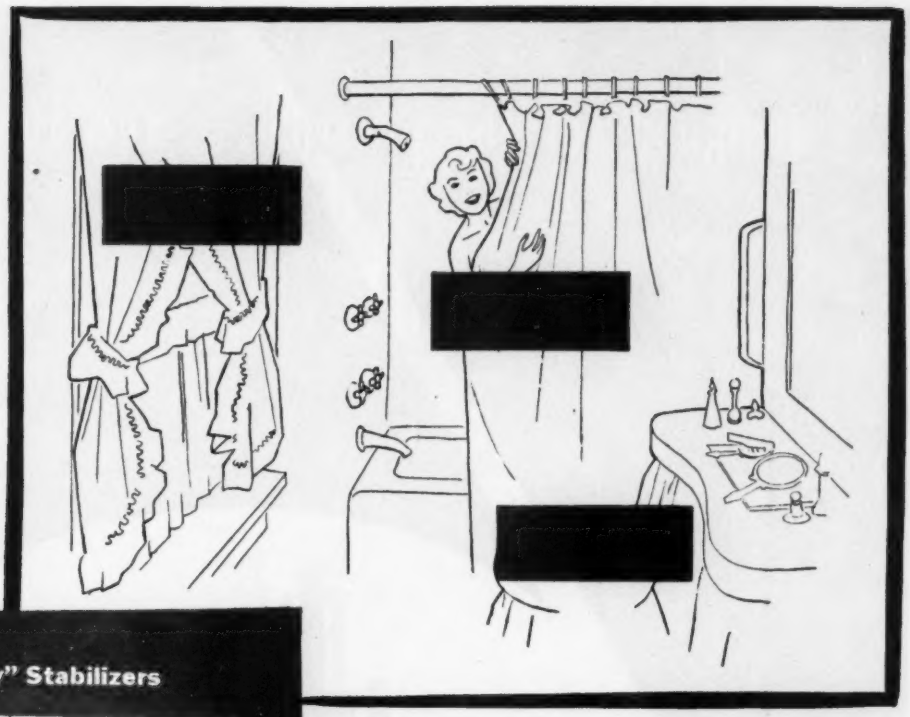
R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING, PHILADELPHIA 5, PA.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE • ACCUMULATORS • ALLEVIATORS • INTENSIFIERS



"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
	Highly translucent film and sheeting
DYTHAL (Dibasic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Dibasic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols. Exceptional weathering characteristics
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

Dutch Boy*

*Reg. U. S. Pat. Off.

CHEMICALS *

NATIONAL LEAD COMPANY

111 Broadway • New York 6, N. Y.

In Canada: **CANADIAN TITANIUM PIGMENTS LIMITED**

630 Dorchester Street, West • Montreal

For brightly colored... highly translucent vinyls...

stabilize your film and sheeting with "Dutch Boy" Plumb-O-Sil C

When you stabilize your vinyls with "Dutch Boy" Plumb-O-Sil C, you can be sure of two things.

1—You'll get film and sheeting with good color—good, clear color. Plumb-O-Sil C does not affect the color because it has no appreciable tinting strength. It gives you excellent stability in deep shades and vivid colors. And it performs well with most dyes and pigment additions.

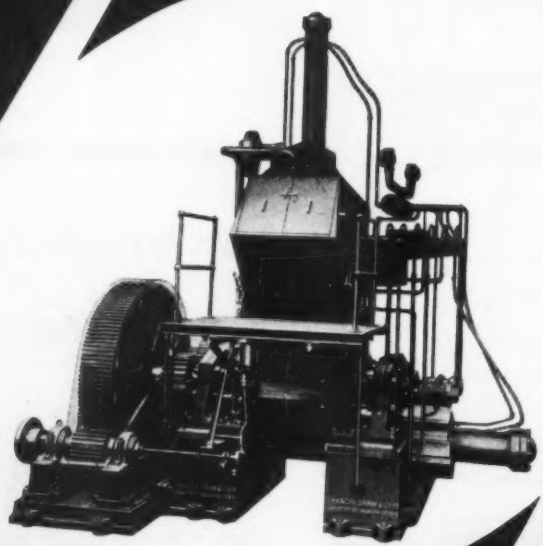
2—You'll get highly translucent film stock. Plumb-O-Sil C's refractive index closely coincides with that of vinyl chloride resin.

In addition to these product advantages, you'll also find "Dutch Boy" Plumb-O-Sil C gives heat stability and requires no predispersion.

For additional information, including technical data on Plumb-O-Sil C, just write. And if you have a special problem in stabilizing your vinyls, consult our technical staff for assistance.

designed for the present . . . and the future

Pioneers in the design and development of machinery for the Rubber and Plastics Industries, SHAW have consistently produced better machines. This tradition is continued with the SHAW Intermix, the most versatile Heavy Duty Internal Mixer manufactured today.



INTERMIX

THE MODERN ENCLOSED MIXING MACHINE

The Shaw Intermix compounds natural and synthetic rubber at lower temperatures than usual with other internal mixers, yet it can also be steam heated for dealing with plastics and similar substances.

SHAW

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Industry's headquarters for the best in plastic and rubber machinery

ENQUIRIES TO FRANCIS SHAW (CANADA) LTD., GRAHAMS LANE, BURLINGTON, ONTARIO, CANADA

Only Fast-Processing SANTICIZERS Give You All 6 Advantages

1.

Give excellent processing with filler contents up to 400 parts p.h.r., making them useful in vinyl floor tiles, extrusion weltings, garden hose, window spline channeling.*

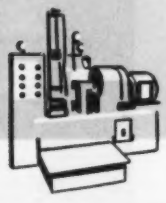
**Parts per hundred of resin.*

2.

Permit calendering at 20° to 30°F. lower temperature than normal, yet retain tensile and tear strengths.

3.

Allow the fusion of plastisols and organosols at low temperature, or at increased production cycles at the same temperature.



4.

Speed up Banbury processing time from 25 to 50%.

5.

Speed up dry blending cycles prior to extrusion.

6.

Increase extrusion rates up to 80%.

Prove these advantages to *yourself*. Test Santicizer 140, 141 or 160 in your plant. Find out what they can do for you.

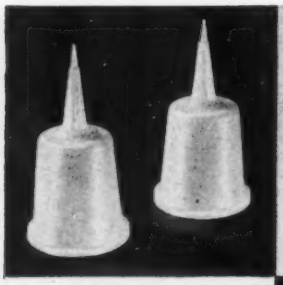
For information on prices, delivery and performance, call the nearest sales office or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 N. Twelfth Blvd., St. Louis 1, Missouri.

Santicizer: Reg. U. S. Pat. Off.

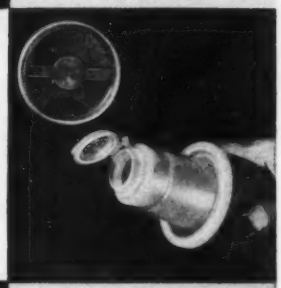
PLASTICIZERS

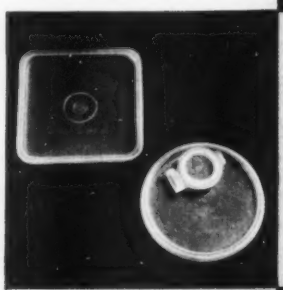
MONSANTO
CHEMICALS—PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!





Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

TUPPER!
TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

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Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

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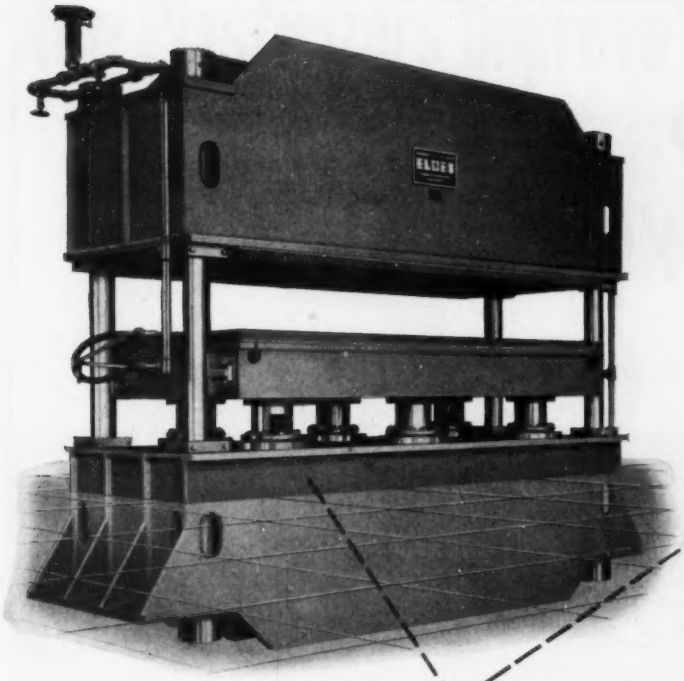
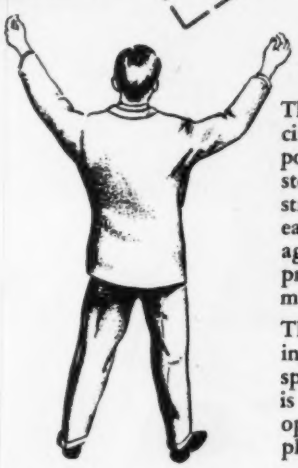
DEPARTMENT M-12



PUT YOUR "Pressing Problems" UP TO ELMES

Elmes 450-Ton Hot Plate Press

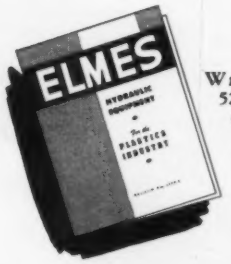
Hot Plate Dimensions: 106" L-R x 55" F-B
Stroke and Opening: 14"



Custom-built ELMES Hot Plate Press molds low-pressure polyester resins

This Elmes 450-Ton Hot Plate Press has been designed specifically to customer requirements for molding of low-pressure polyester resins. Construction is almost entirely of welded steel. Crown, bed, platen are heavy, one-piece weldments, fully stress relieved. Six single acting cylinders, of 75-tons capacity each, are set into the press bed, unrestrained. Rams bear against finished pads beneath the moving platen, and the press system is arranged so that only the two center cylinders may be actuated if desired.

The hydraulic system is self-contained. A dual-pressure pumping unit provides a high closing speed and moderate pressing speed. Gravity returns the platen downward. Press operation is completely pushbutton controlled. During semi-automatic operation an adjustable timer effects press opening upon completion of the work cycle.



Write for Bulletin 5200-A "Elmes Hydraulic Equipment for the Plastics Industry."

WHAT ARE YOUR REQUIREMENTS IN PLASTICS MOLDING PRESSES?

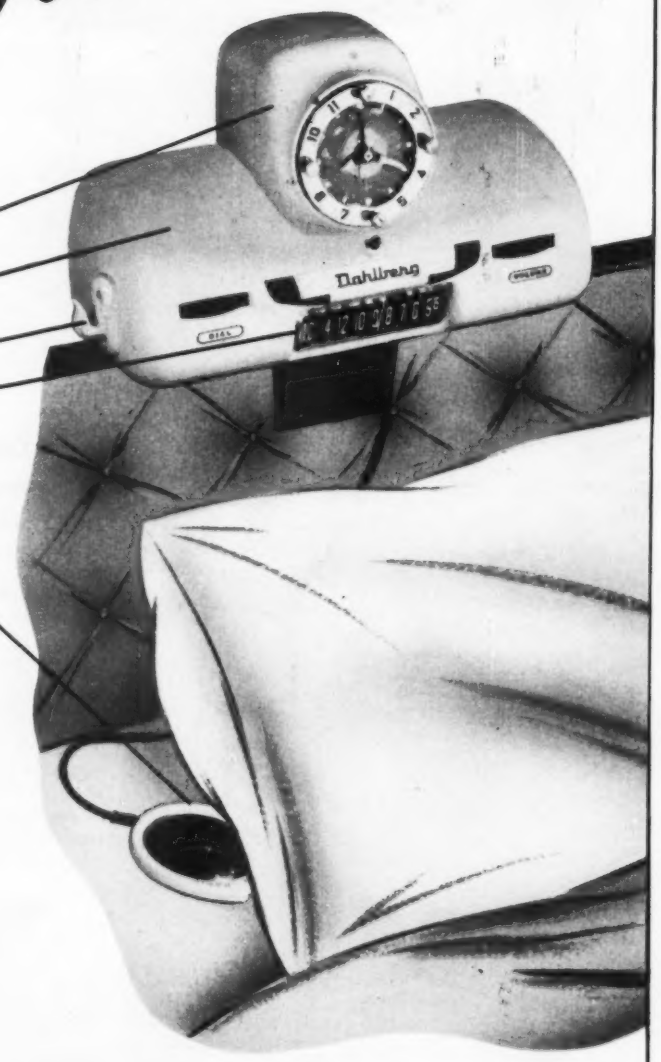
Elmes designs and builds a *complete line* of presses for the plastics molding industry. Whatever your requirements—compression or transfer molding presses, small production or laboratory presses, in standard designs or custom-built to specifications—it will pay you in profits to *"put your pressing problems up to Elmes."* Why not discuss your needs with our engineering staff? There is no obligation whatsoever.

American Steel Foundries

ELMES ENGINEERING DIVISION

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

THE WORLD THROUGH YOUR PILLOW



CLOCK HOUSING
RADIO CABINET
SPEAKER HOOK
DIAL FACE
SPEAKER FRAME
(2 parts)

Our skillful molding of six important plastic components, combined with the excellent *Dahlberg pillow speaker radio makes possible a new and unique experience in radio listening.

*The Dahlberg Co., Minneapolis, Minn.

Minco

MINNESOTA PLASTICS CORPORATION

INJECTION MOLDERS OF THERMOPLASTICS

GARFIELD 5368 • 366 WACOUTA ST., ST. PAUL 1, MINNESOTA • NESTOR 3144

New Plasticizers Improve Vinyl Compounding

"There's a touch of Tennessee in Better Plastics"

TENNESSEE announces Benzoflex 9-88 and Benzoflex 2-45 for PVC resins and other film formers.

These new primary plasticizers from TENNESSEE research bring these important advantages to manufacturers of film, plastisols, organosols, extrusions and emulsions:

Impart good tensile strength, elongation, elasticity and shore hardness to vinyl films.

Produce plastisols and organosols of low, permanent viscosity.

Volatility from films is very low. Does not crystallize at low temperatures.

Have strong solvent action on vinyl chloride resins.

Their cost is low.

Benzoflex 9-88 and 2-45 are also compatible with cellulose acetate and nitrocellulose type resins.

Write today for complete information and samples of Benzoflex plasticizers.

TENNESSEE
PRODUCTS & CHEMICAL
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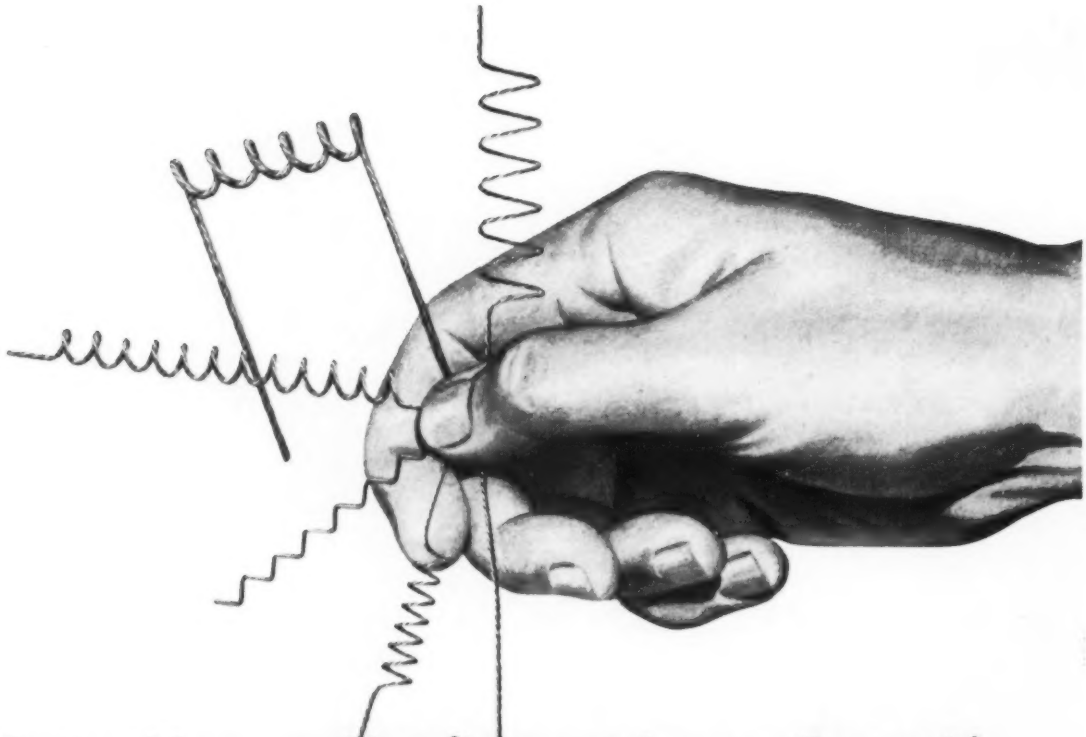
NASHVILLE, TENNESSEE

Producers of: FUELS · METALLURGICAL PRODUCTS · TENSULATE BUILDING PRODUCTS · AROMATIC CHEMICALS WOOD CHEMICALS · AGRICULTURAL CHEMICALS



Better Vacuum Metalizing at Lower Cost with

SYLVANIA TUNGSTEN COILS

Sylvania tungsten source heater coils give you maximum performance because they're specially designed to overcome all problem conditions likely to be encountered today.

Because they are made from stranded wire, Sylvania coils have a more effective area for the retention and vaporization of the coating material. They give maximum evaporating capacity for any specific job. They assure a uniform flow of metal . . . in rate, intensity, and direction.

Money-saving, too!

Sylvania tungsten coils save you money because they actually stay on the job longer. The combination of stranding and coiling allows much greater expansion and contraction during the cycle with greatly reduced mechanical breakage . . . giving you more shots from each filament.

A complete line

Now Sylvania offers you a complete line of tungsten coils . . . each designed for a specific metalizing job. Or, if you form your own coils, Sylvania tungsten wire is yours in a full range of diameters, in stranded cable or single strands . . . quality controlled from ore to finished product.

Remember, our engineers are at your service in the solution of any vacuum metalizing problem. New illustrated folder gives valuable suggestions and shows why you'll save money and material with Sylvania's improved tungsten coils. For your free copy, address: Sylvania Electric Products Inc., Dept. 3T-5012, 1740 Broadway, N. Y. 19, N. Y.

SYLVANIA

LIGHTING • RADIO • ELECTRONICS • TELEVISION

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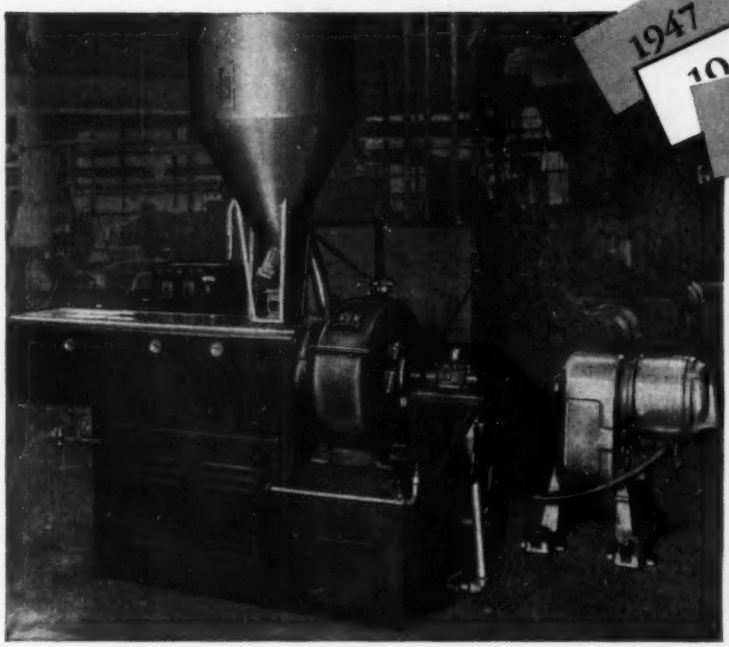
NEW NRM EXTRUDERS in



1947
1948
1949
1951
1952
1953
for

ANESITE COMPANY

"We've purchased six new NRM Extruders in less than eight years," states William L. Hess, Vice-President of Anesite, "because the outstanding performance of each one, as it was operated in our plant, seemed to dictate *another* NRM."

"We selected NRM Extruders in the first place," Mr. Hess continues, "because we considered them well designed and well built for thermoplastic extrusions. We wanted machines that have interchangeable parts. Our employees are able to work from one NRM to another without any delays or interruptions in production. Our NRM's have proved dependable and have given excellent service in every way."

In 1946, William L. Hess and George L. Hess founded the Anesite Company, Chicago, to extrude standard and custom thermoplastic pipe, tubes, rods and special shapes. In the few years since, the high quality of Anesite Extrusions has resulted in their widespread distribution, and gained for the company an international reputation as a leader in its field.

We're glad that NRM Extruders are playing an important part in the rapid growth and outstanding success of the Anesite Company. We know, too, that NRM Extruders can contribute just as importantly to the success of *any* plastics processor, by their capacity for high output of top quality extrusions without excessive maintenance. If *you* are planning to purchase plastic extruding equipment, let us send the *facts* on NRM's superior design and construction features. They clearly show *why* so many leading plastics manufacturers, the world over, *prefer* NRM Extruders and Equipment. A post card brings full details, promptly, without obligation.

2211

NATIONAL RUBBER MACHINERY COMPANY

NRM

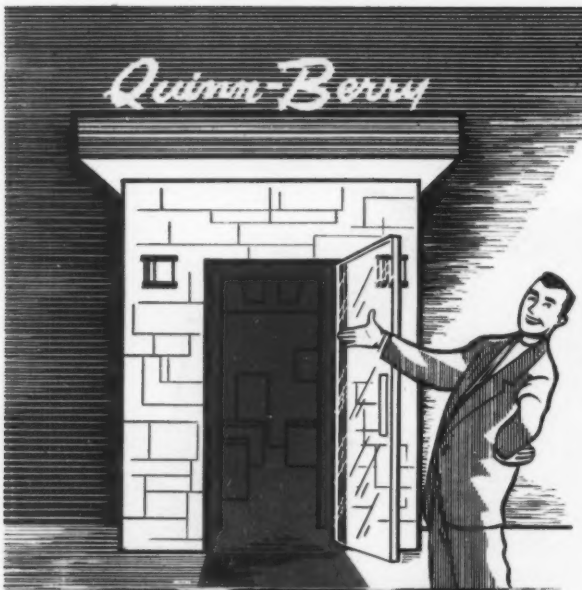
Our 25th ANNIVERSARY 1928-1953

Creative Engineering

General Offices & Engineering Laboratories: Akron 8, Ohio
East: 384 Getty Ave., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Cal.
Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.

Quinn-Berry

Designed to serve you...

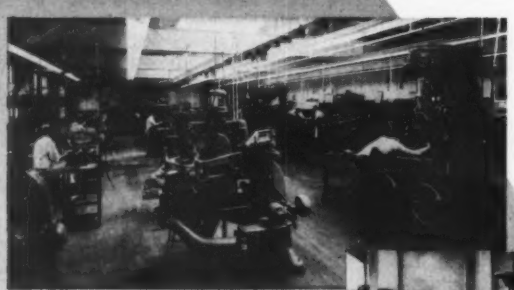


The new, larger quarters now occupied by Quinn-Berry Corporation are designed to make possible the most efficient production methods. Modern equipment, excellent lighting and practical floor planning combine to produce highest quality workmanship.

Illustrated here are portions of the new Quinn-Berry plant. Here you can see the complete services available to you at Quinn-Berry. Every step, from original design to finished product, is here under one roof. Our molds are made in our machine shop by some of the finest craftsmen in the country.

Our production experience covers nearly every industry . . . aviation, electrical, business machines, housewares, automotive and many more.

These modern, efficient facilities and our diversified design and production experience are yours for the asking. Consult with us the next time you have a problem involving plastics.



Here are pictured three departments in the new Quinn-Berry plant. At top is a portion of the engineering department where parts and molds are designed. Next is a section of large machine shop where we make our own molds. At bottom is a view of press room showing row of newly installed, modern presses.

BRANCH OFFICES

Harry R. Brethen
15 Lawrence
Detroit, Michigan
Townsend 8-2577

James L. Fitzsimmons
39 Lackawanna Plaza
Bloomfield, New Jersey
Bloomfield 2-1040

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Greenfield 6-7161

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QUINN-BERRY CORP.

2651 WEST 12th STREET, ERIE, PENNA.

PLASTICS

MOLDERS OF ALL TYPES OF THERMOPLASTIC MATERIALS

For Low Cost Permanence in Vinyl Products

PARAPLEX G-62
PARAPLEX G-60
MONOPLEX S-71
PLASTICIZER-STABILIZERS

For vinyl products whose low cost and permanence are selling points, the inexpensive plasticizing and stabilizing effects of PARAPLEX G-62, PARAPLEX G-60, and MONOPLEX S-71 are ideal.

PARAPLEX G-62, a newly developed plasticizer-stabilizer for vinyl resins, excels in tests for heat and sunlight resistance—no discoloration or embrittlement occurs even after 1200 hour exposure in the Fadeometer. Because of its stabilizing effect, PARAPLEX G-62 permits fast, high-temperature processing without discoloration, and savings in cost result. In addition, PARAPLEX G-62 is a permanent plasticizer of low volatility, and resists extraction by oil, gasoline, and soap and water.

PARAPLEX G-60 possesses many of the qualities of PARAPLEX G-62, and is superior in soap and water resistance. It is also more efficient and lower in cost.

MONOPLEX S-71 is a monomeric ester that combines extremely low temperature flexibility with the stabilization action of PARAPLEX G-62 and PARAPLEX G-60. Compared with other low temperature plasticizers, it is low in volatility.

To learn which PARAPLEX or MONOPLEX plasticizer-stabilizer best fits your vinyl needs, write for our plasticizer manual Dept. FF-2.

PARAPLEX and MONOPLEX are trade-marks, Reg. U. S. Pat. Off. and in principal foreign countries.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

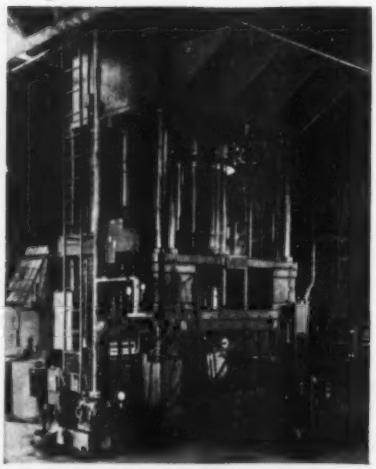
THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

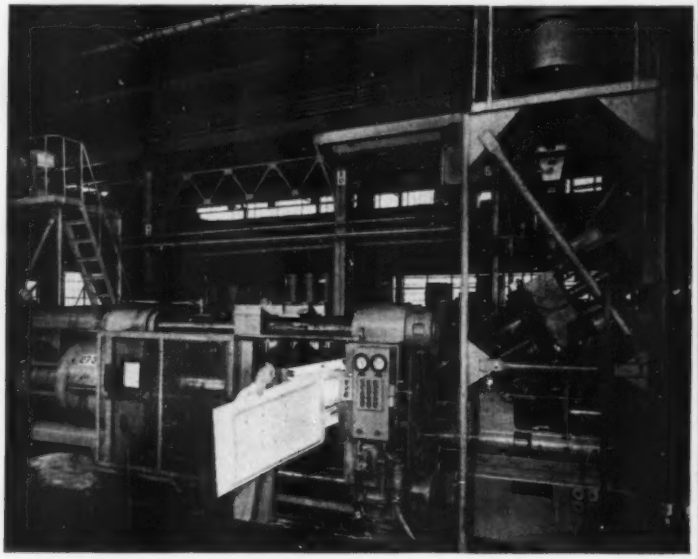
Complete facilities for making tough, strong, reinforced plastics as large as 5' x 7' x 2'

Good ideas molded in plastics by



This 2,000 ton compression press molds a complete console television cabinet every few minutes.

Batteries of huge 300-oz. injection presses produce—in one shot—a complete inner door panel for a 12 cu. ft. refrigerator.



General American

You may be able to do more with plastics than you thought you could! At General American, we're working with manufacturers who never before had considered plastics. Old limitations of size, shape and color are being removed. New design possibilities and styling are adding saleability to products and parts of all kinds.

By taking full advantage of equipment that is unmatched anywhere for large-scale injection, compression and reinforced plastics molding, we've been able to improve old products, mold many new products—as well as cut production costs for customers.

We'd like to help you see your ideas take form in plastics *correctly applied.*

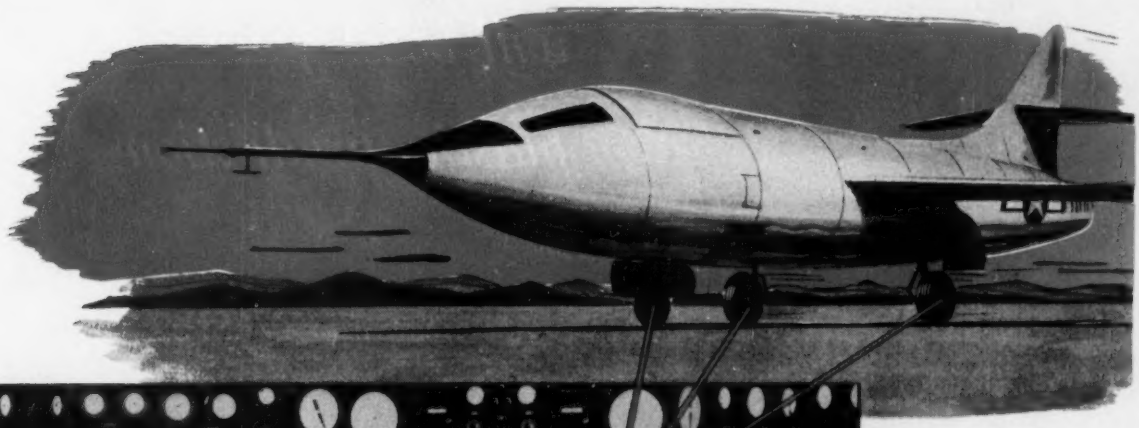
See General American for plastics molding

PLASTICS DIVISION
General American Transportation Corporation
135 South La Salle Street • Chicago 90, Illinois
Phone: Financial 6-4100

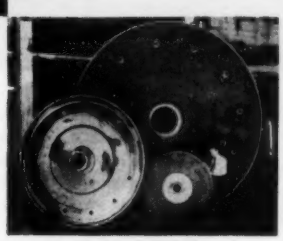
PLASTICS DIVISION GENERAL AMERICAN TRADE MARK

FROM Kittyhawk TO Muroc

FROM LANDING SPEEDS OF 20 MPH TO 300 MPH



This Dynamometer Bench Board controls over 200 tons of complicated precision machinery comprising an ADAMSON AIRCRAFT BRAKE AND TIRE TESTING MACHINE. On it are recorded the results of tests made at landing speeds up to 300 M. P. H.



Some Inertia Wheels used in ADAMSON AIRCRAFT BRAKE AND TIRE TESTING MACHINES. Large wheel is 16 ft. in dia.; wt. 185 tons. Peripheral speeds to 200 M. P. H. Max. Vibration .0005 to .001 inch.

ADAMSON Engineering and Testing Equipment have kept pace with Aviation progress

Adamson has designed and/or built complete, and installed, for the armed services and for commercial flying, more AIRCRAFT BRAKE AND TIRE TESTING EQUIPMENT than all other manufacturers combined. Adamson Testing Equipment is in use the world over; and Adamson Engineering is acknowledged pre-eminent in this field.

Among those Adamson serves as consultants or as designers and builders are:

The U. S. Navy
The U. S. Air Force
Bendix Aviation Corp.
General Tire & Rubber Co.
B. F. Goodrich Co.
Goodyear Tire & Rubber Co.
Schenuit Rubber Co.
U. S. Rubber Co.
Firestone Tire & Rubber Co.
British Ministry of Supply
French Ministry of Supply
N. A. C. A., and many others.

Whether you are in aviation or not, ADAMSON'S CREATIVE ENGINEERING and precision manufacturing facilities are available to you. Designing processes and building precision machinery for unusual and exacting requirements, has been Adamson's business for more than 60 years.

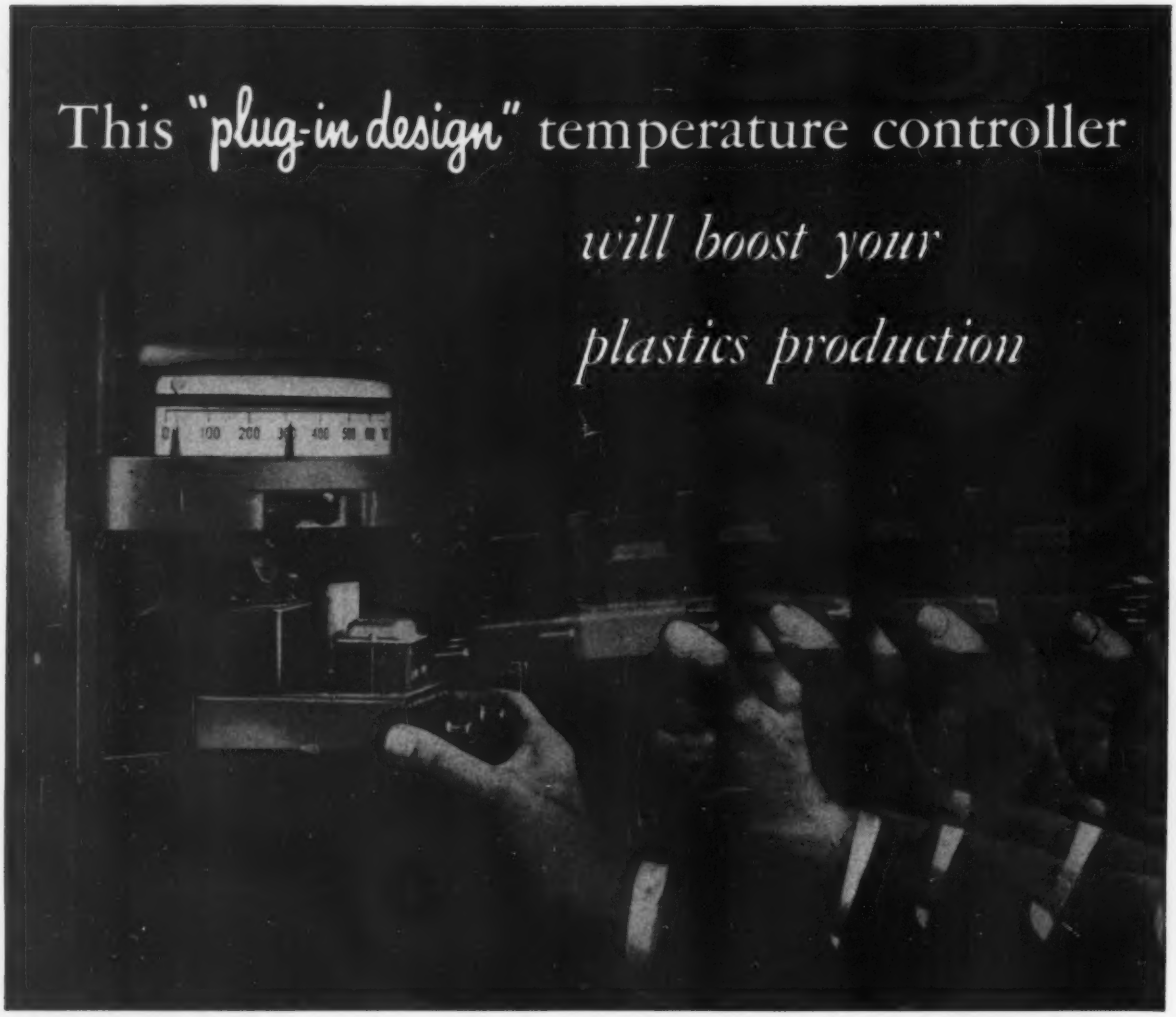
Your inquiry entails no obligation. Why not write today?

Adamson United Company
730 CARROLL STREET
AKRON 4, OHIO

Sales Offices in Principal Cities
SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY CO.
Plants at: Pittsburgh • Vandergrift • New Castle
Youngstown • Canton

Adamson United
AIRCRAFT BRAKE AND TIRE-TESTING MACHINES

This "plug-in design" temperature controller *will boost your plastics production*



THE PICTURE above shows how easy it is to interchange a complete control unit of the *Pyr-O-Vane* temperature controller. It takes only *seconds*—and your extruder or molding press never gets tied up for instrument service.

Simplified maintenance is only one of the many benefits that you get from the *Pyr-O-Vane* controller. Equally important is its ability to hold critical temperatures with the hair-splitting precision that pays you big dividends . . . in faster cycle times, fewer rejects, accurately dimensioned moldings, better uniformity of color and finish.

Ideal for all types of extruders, injection machines, press platens, molds, and dies—the *Pyr-O-Vane* controller is available as a contact type instrument for on-off, two-position or three-position control . . . or as a proportional controller—the Pulse *Pyr-O-Vane*—which provides time-proportioning action. The control units are complete, plug-in components that can be readily interchanged depending on the type of control required for a specific application. The galvanometer unit, with its indicating scale, also plugs in; range changing becomes a simple matter of inserting a different unit.

Your local Honeywell engineering representative will be glad to discuss how these versatile controllers can go to work in your plant. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4437 Wayne Ave., Philadelphia 44, Pa. Service centers in more than 90 principal cities.

● **REFERENCE DATA: Write for Catalog 1053 on "*Pyr-O-Vane* Controllers."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

The finest name
in Rutile Titanium Dioxide

Glidden ZOPAQUE*-R

...gives you a whiter white...and it's easier to grind

Glidden research has achieved greater whiteness and a highly accelerated dispersion rate in new Glidden ZOPAQUE-R. These new developments combine to produce pigments with exceptional hiding power, outstanding gloss and color retention and low reactivity.

Write today for more details on new Glidden ZOPAQUE-R, the finest name in Rutile Titanium Dioxide.

ZOPAQUE-R33—For latex paints
ZOPAQUE-R66—All-purpose Rutile
ZOPAQUE-R88—Non-chalking Rutile

THE GLIDDEN COMPANY

CHEMICALS • PIGMENTS
METALS DIVISION

Baltimore, Md. • Collinsville, Ill. • Hammond, Ind.
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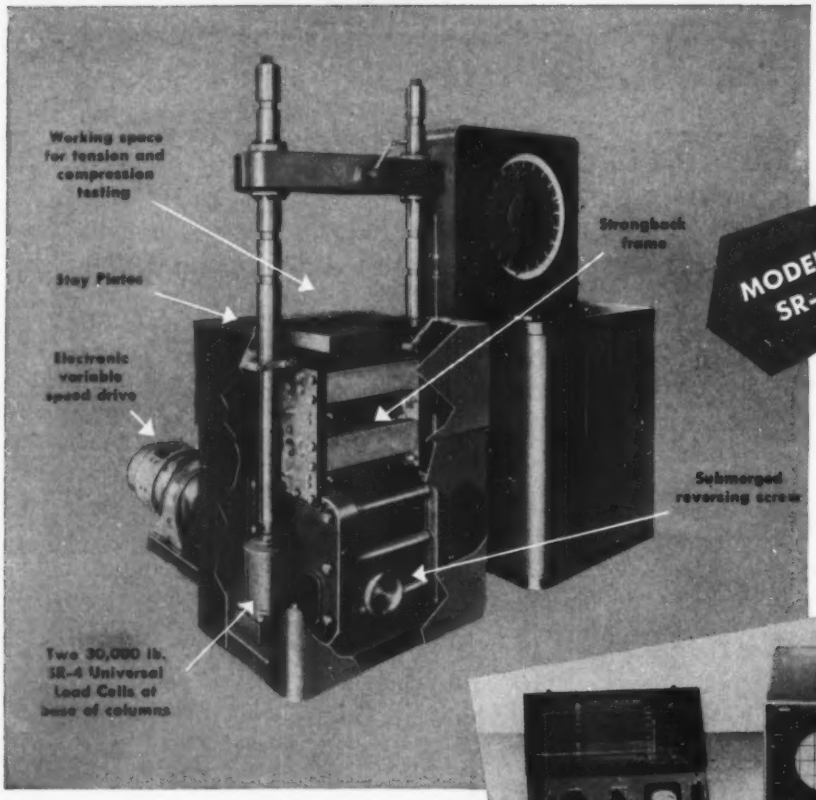
Another achievement of Glidden Planned Research

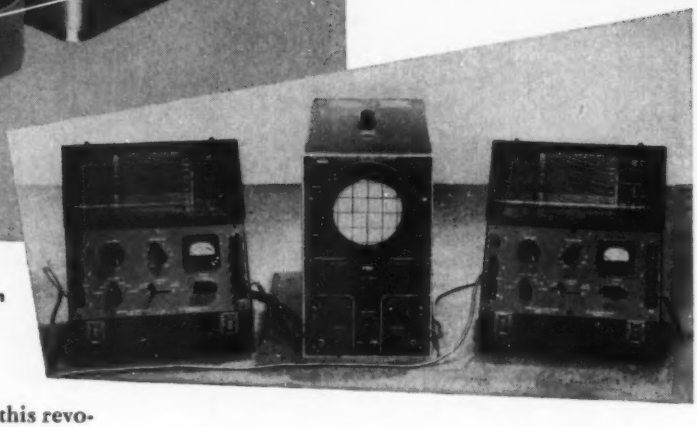
QUALITY Glidden PRODUCTS

*Trade Mark Reg. U. S. Pat. Off.

NOW! A Machine Fast Enough for SHOCK Tests on Structures


Working space for tension and compression testing
Stay Plates
Electronic variable speed drive
Two 30,000 lb. SR-4 Universal Load Cells at base of columns
Strongback frame
Submerged reversing screw

MODEL FGT BALDWIN-EMERY SR-4 TESTING MACHINE



Oscilloscope X-Y diagram system records stress-strain curves in shock testing

The extraordinary high speed of response of this revolutionary new Baldwin-Emery universal testing machine, paired with an oscilloscopic X-Y diagram, enables it to measure and record shock tests on complete structures. Its SR-4 load cells and SR-4 type extensometer make it capable of responding to the rates required by shock conditions.

The load cells and extensometer feed signals to the oscilloscope through pre-amplifier circuits. An instantaneous stress-strain curve and its two axes then appear on the oscilloscope screen. It is possible to have this screen photographed continually to record changes in the shape of the stress-strain curve as the structure itself changes.

Its unique aptness for such shock tests is one of the reasons why the FGT SR-4 Testing Machine is being recognized as *the greatest advance in materials testing equipment in twenty years.*

Full details on this latest contribution of Testing Headquarters are in Bulletin 4202. For your copy, write to Dept. 2226, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

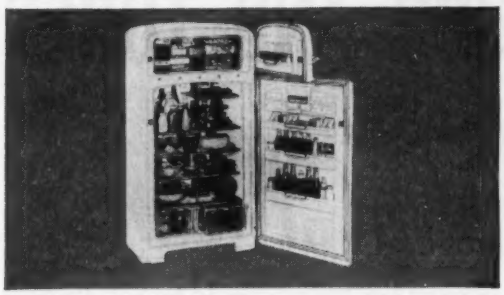
BALDWIN BLH LIMA-HAMILTON

TESTING HEADQUARTERS

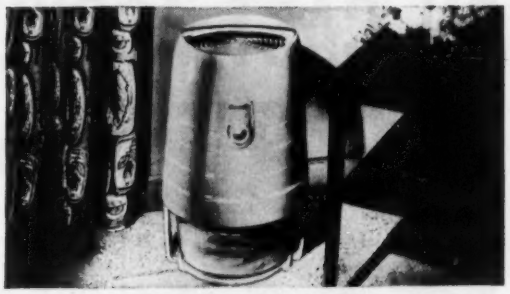
BALDWIN-LIMA-HAMILTON

General Offices: Philadelphia 42, Pa. • Offices in Principal Cities

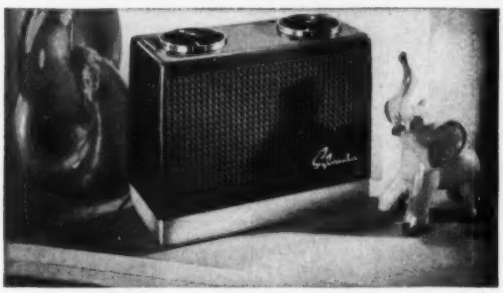
Polystyrenes you helped to create in '53



You needed a plastic with high impact resistance and easy flow in molding for refrigerator door liners. Koppers Modified Polystyrene MC-305 was developed to solve your problem.



You needed a plastic with high impact, high heat resistance, fast setting, and an excellent finish for moisture conditioner housings. Your demand was answered with Koppers Modified Polystyrene MC-309.



You needed a medium impact, high heat-resistant plastic with high lustre . . . for radio cabinets where breakage and scuffing on ejection presented a reject problem. Koppers Modified Polystyrene MC-409 had the exact characteristics to do the job.

You needed a plastic with impact resistance, toughness, easy moldability, economy and ability to reproduce engineering details in toys. Koppers engineers recommended Modified Polystyrene MC-405 to fill these requirements.

KOPPERS POLYSTYRENES

Type 3	General Purpose Polystyrene
Type 7	Improved Heat Distortion Temperature
Type 8	Highest Heat Distortion Temperature
MC-185	High Impact, Lowest Water Absorption Rate
MC-301	High Impact, Improved Heat Distortion Temp.
MC-305	High Impact, Easy Flow
MC-309	High Impact, Highest Heat Distortion Temp.
MC-401	Medium Impact, Improved Heat Distortion Temperature
MC-405	Medium Impact, Easy Flow
MC-409	Medium Impact, Highest Heat Distortion Temp.

• Here are four success stories about Koppers Polystyrenes. Each application presented its own special problem, and in each case a Koppers Modified Polystyrene was created to meet these special requirements.

The best polystyrene for you is the one that embodies the very qualities required to make your product more serviceable and more attractive. That's why the family of Koppers Modified Polystyrenes is constantly growing, at your request, to meet your needs.

Why not contact a Koppers representative for more information about the wide range of Koppers Regular and Modified Polystyrenes? They are anxious to help you select the exact polystyrene that will improve your product and lower your production costs.

Koppers Plastics Make Many Products Better and Many Better Products Possible.

KOPPERS ®

Guaranteed by Good Housekeeping

KOPPERS COMPANY, INC., Chemical Division, Dept. MP-123, PITTSBURGH 19, PENNSYLVANIA

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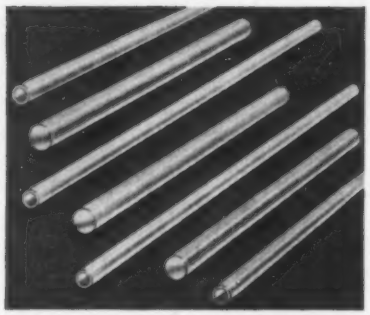
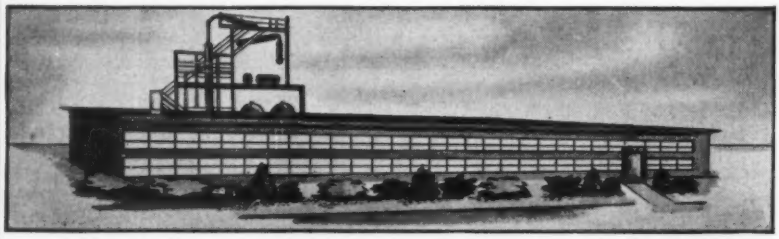
CADILLAC ANNOUNCES PRODUCTION ON CAST ACRYLIC RODS AND TUBES



New "CADCO" Plant Now In Full Production

The Cadillac Plastic Company has been licensed by E. I. Du Pont De Nemours & Company to produce their famous transparent cast acrylic rods and tubes by the same exclusive process formerly used by Du Pont.



CADCO RODS AND TUBES ARE NOW AVAILABLE

CADCO TYPES

	General Purpose	Heat Resistant
RODS	HC-217	HC-218
TUBES	HC-205	HC-206

Cadco Cast Rods are supplied in random lengths, and in a number of diameters of 0.250 inches to 6 inches.

Cadco Cast Tubes are manufactured in a length of about 52 inches and in a number of outside diameters from 1-1/2 inches to 6-3/32 inches, having wall thicknesses of 1/8, 3/16 and 1/4 inch.

HOW CADCO CAN HELP YOU

Cast Acrylic rods and tubes can readily be adapted to solve many new problems. Cadillac will gladly work with you by suggesting cost-saving ways to improve your products or help you develop an item which does not yet exist.

THE NEW NAME FOR CAST ACRYLIC RODS AND TUBES . . .

LARGE MODERN FACILITIES ASSURE ADEQUATE SUPPLY OF HIGH QUALITY CADCO PRODUCTS

To assure industry that cast acrylic rods and tubes will no longer be in short supply, Cadillac has purchased the extensive manufacturing facilities of Du Pont for making Cadco products. The new modern plant is devoted to producing rods and tubes of the finest quality in a wide range of sizes and in greater quantities.

Cadco Cast Acrylic Rods and Tubes have a unique combination of properties which give them a wide range of uses both in industrial and consumer fields. The Cadillac Plastic Company invites inquiries from manufacturers now using or who are contemplating the application of plastics to present or future products.

FREE BOOKLETS: "157 Ways to Use Plastics for Maintenance"; "Square Inch to Square Foot Conversion Table"; "How to Work With Plexiglas."

CADILLAC LARGEST PLASTIC SUPPLY HOUSE

Cadillac was first organized to warehouse and supply plastic sheets, rods and tubes for fabricators, factory maintenance departments and for industry generally. This extensive business will continue to service its many customers.

Robert and Richard Jacob, President and Vice President respectively, announce that while the new modern Cadco manufacturing plant is exclusively engaged with the production of the finest quality rods and tubes, Cadillac warehouse facilities enable them to supply you with Plexiglas, Vinylite, Nylon and Acetate in quantities for all needs... quickly, economically. *Inventories and prices on request.*

IMMEDIATE DELIVERY ON SHEETS — RODS — TUBES

- Plexiglas
- Vinylite
- Nylon
- Acetate

REPRESENTATIVES IN PRINCIPAL CITIES

FOREMOST IN PLASTICS

CADCO

- SHEETS
- RODS
- TUBES

cadillac plastic company

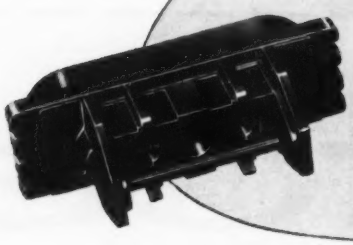
15111 Second Blvd., Detroit 3, Michigan
Chicago Warehouse, 727 Lake Street
Chicago 6, Illinois

Precision

This is a donor cannula . . . a connector used in blood transfusion equipment. Precision was required because the diameter of the opening at the tip controls volume of flow through the cannula. It was transfer molded of general purpose phenolic in a 40 cavity mold.

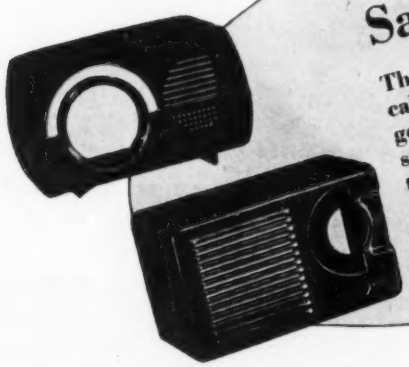
Uniformity

This contact block for a timer switch was transfer molded of impact phenolic. Each cavity in this die required over 15 critical dimensions that were held to close tolerances. The result was absolute uniformity . . . satisfactory operation of the timer switches was assured.



Sales Appeal

The sales appeal built into these radio cabinets is typical of the results you can get for your products when you choose a supplier equipped with complete injection, transfer and compression molding equipment in a wide range of machine capacities.



What Are YOUR Plastics Requirements?

Whatever they are, Mallory Plastics engineers will help you select the right materials for the job . . . engineer and build precision molds to meet your most exacting requirements. From start to finish, Mallory Plastics' complete service can handle your job economically . . . with delivery to match your production schedules. Write or call us today. Our engineers will be glad to discuss your requirements.

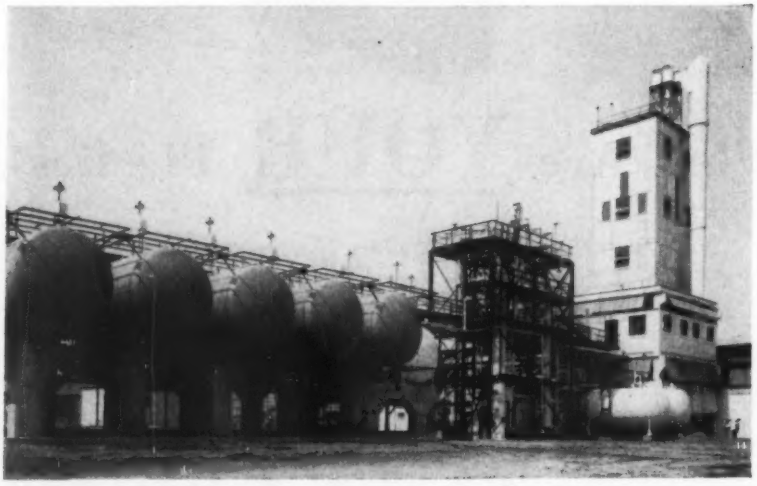
P. R. MALLORY PLASTICS, INC.

3670 MILWAUKEE AVE. • CHICAGO 41, ILLINOIS

A subsidiary of P. R. MALLORY & CO. Inc. MALLORY

Chemicals you live by

A great source



Investment in instruments, high in all chemical plants, is twice the average in this new DIAMOND *plant. Over 400 controlling, indicating and recording devices guard the quality of* DIAMOND PVC.

New of PVC

If you use polyvinyl chloride, either as a processor of resin, or as a user of any of the thousands of end products, you now have the advantages and protection of a great, new source of supply.

DIAMOND ALKALI has completed, at Houston, Texas, the world's most modern, most advanced plant for the production of PVC resins. All of the production of this plant will be available to plastics processors.

As a safeguard to uniform quality and uninterrupted supply, every production step, from raw materials to resin, is integrated at this one plant and is under the continuous control of DIAMOND engineers.

In addition, plastics processors will have the assurance of high quality and prompt delivery associated with all DIAMOND products and the cooperation of an experienced technical staff equipped with complete research, test and product development facilities.

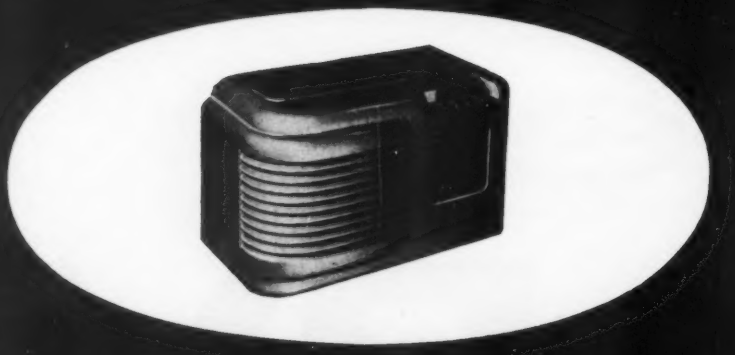
DIAMOND PVC will be produced in new and improved formulas as they are developed under DIAMOND's continuing research programs.

For information on DIAMOND PVC and the cooperation of the DIAMOND Technical Staff, write to DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI COMPANY
CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS ®

for **TOUGH** molding jobs . . .



METASAP* STEARATES deliver easier mold release

When you have a tricky molding problem . . . when you're deep drawing or producing large pieces, Metasap Stearates in the molding compound provide outstanding lubrication for easy ejection from the mold.

Either incorporated into the molding compound or dusted onto mold surfaces Metasap Zinc or Calcium Stearates give outstanding lubrication so that lower ejection pressures are needed. Thus, you can expect increased output, fewer rejects, improved finished products and longer mold life.

So specify compounds containing Metasap Stearates or incorporate them directly into your own molding compound. Metasap Technical Service will help you with the proper material and mixing procedure for your needs.

. . . and to produce economical plastigels

As a thickening agent for plastisols, Metasap provides a complete line of quality Stearates. We'll be glad to make available to you free experimental samples of Magnesium, Barium, Calcium and Aluminum Stearates. They are ready for immediate shipment now.

METASAP CHEMICAL COMPANY, Harrison, N. J.

Branches: CHICAGO • BOSTON • CEDARTOWN, GA. • RICHMOND, CALIF.

Stocks at: Cleveland, Ohio; Louisville, Ky.; Los Angeles, Cal.; Portland, Ore.; Spokane and Seattle, Wash.

*Reg. U. S. Pat. Off.

METASAP CHEMICAL COMPANY REG. U.S. PAT. OFF.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

By Courtesy of Messrs. Melwood Thermoplastics Ltd.

ADVANCES in EXTRUSION

The most recent installation is the Windsor R.C.100 extrusion machine. It has been installed at the works of Messrs. Melwood Thermoplastics Ltd., of Harpenden, England.

The tubes produced are of 3" diameter with a wall thickness of ¼".

The material used is completely unplasticised P.V.C. Melwood's hope to make 6" and 8" tubes of a special material later in the year. Subsequently tubes of even greater diameter will be made. One of the materials extruded is Tenite II in fluted rod form for screw driver handles.

Write for descriptive literature.

R.H. WINDSOR LTD

LEATHERHEAD ROAD • SOUTH CHESSINGTON • SURREY • ENGLAND

Exclusive U.S.A. Representative:
F. J. Stokes Machine Company,
Philadelphia 20, Pa.

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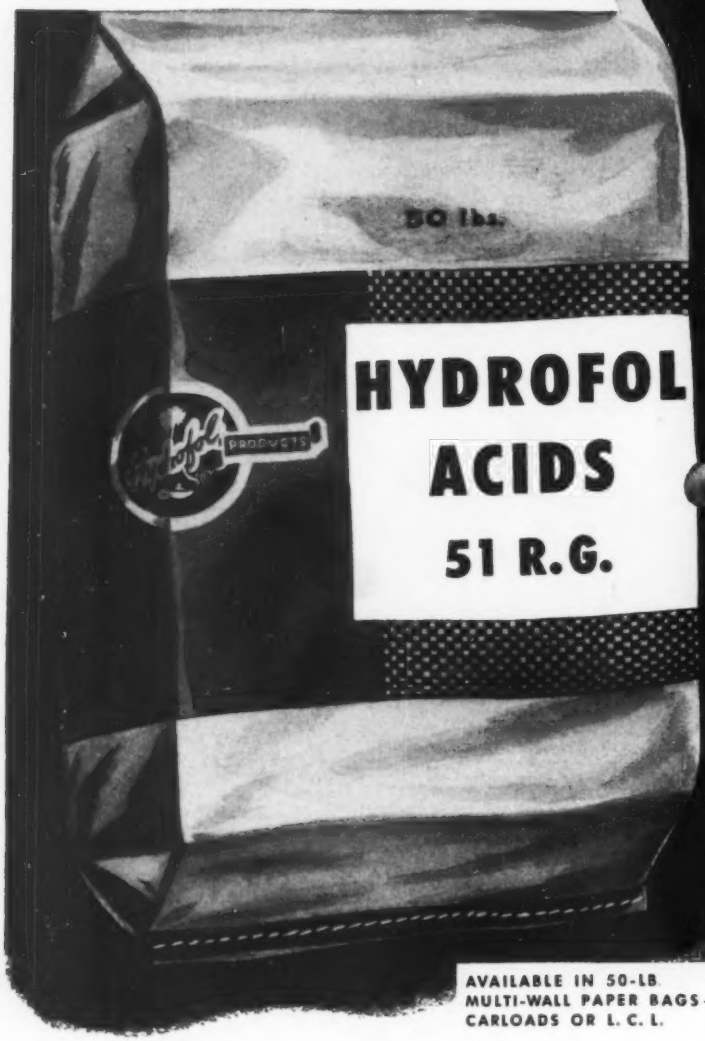
Wilmod Company, Plastics Division,
2488 Dufferin Street, Toronto

announcement...



NOW... ARCHER · DANIELS · MIDLAND to supply rubber-grade stearic acid direct!

AVAILABLE IN 50-LB. MULTI-WALL PAPER BAGS — CARLOADS OR L. C. L.

Hydrofol PRODUCTS

ACIDS
GLYCERIDES
SPERM OILS
ALCOHOLS

NOTHING CHANGES BUT THE NAME!

ADM was the first company to produce hydrogenated fatty acids in commercial quantities for the rubber industry. For many years, however, ADM Rubber-Grade Stearic Acid has been distributed widely under a private label by a supplier of rubber chemicals.

Effective January 1, 1954, the *same* identical product, under the trade name HYDROFOL ACIDS 51 R.G., will be distributed directly by the Chemical Division of Archer-Daniels-Midland Company and its nationwide chain of sales offices and agents.

GET QUALITY CONTROL ... WITH HYDROFOL ... *Produced in any Quantity from SAMPLES to SHIPLOADS*

ARCHER • DANIELS • MIDLAND COMPANY
Chemical Products Division • 2191 West 110th St. • Cleveland 2, Ohio

NOW *Plastic Bottles* ARE PART OF CONTINENTAL'S SERVICE

With the addition to its family of the Elmer E. Mills Corporation, the Continental Can Company once more expands its services to industry and the nation. Our Tailor-Made Package Service now includes the famous Mills-Plastic containers. These smash-proof, zephyr-weight bottles are available in a wide variety of styles—oblong or cylinder, regular or "squeeze," standard or custom-designed. Mills injection molding and extrusion of plastics are other services that now bear the Continental name. Now more than ever, the solution to your packaging problem—whatever it is—will be found at Continental.

MFD. under patents 2,515,093—2,579,390—2,579,399. Other pats. pend.

CONTINENTAL CAN COMPANY

SHELLMAR-BETNER
Flexible Packaging Division

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

offers unexcelled facilities for building your molds

COMPLEX DESIGN

CLOSE TOLERANCE

EXCEPTIONAL SIZE

One of the industry's best-equipped and most ably staffed toolrooms is yours to use, here at **MPc.** Here you will find advanced types of equipment operated by highly skilled, experienced craftsmen.

MPc will make all your molds, operating like your own mold-making department. Or you may wish to call on **MPc** for a single job that won't fit into your production schedule...or a mold that's too large for you to handle...or one that poses difficult engineering problems. **MPc** *samples all molds, regardless of size, and submits piece parts for dimensional check before releasing molds.*

In pacing the advance to ever-larger plastic castings, **MPc** has acquired an unparalleled fund of experience in mold design, engineering and fabricating. Submit your mold-making problems to MOLDED PRODUCTS, 4535 W. Harrison St., Chicago 24, Illinois.

MOLDS FOR

- Compression molding
- Injection molding
- Plunger transfer molding
- Pot transfer molding
- Extrusion molding
- Rubber molding
- Die-casting
- Forging

Etc.

MOLDED MPc PRODUCTS

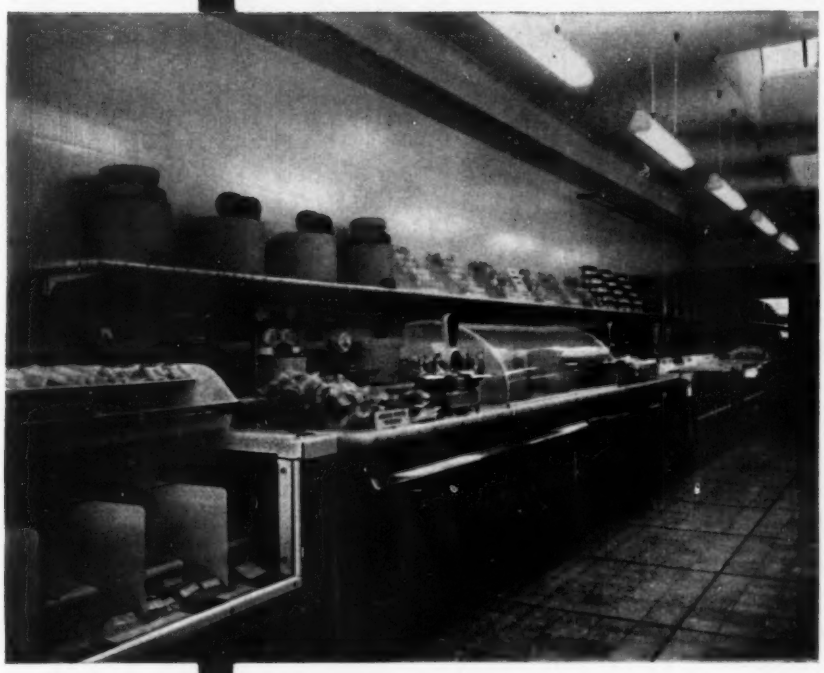
DIVISION OF
ADMIRAL DISTRIBUTORS, INC.

...Pace-Makers in Plastics Molding

MEMBER: COMMITTEE ON LARGE PLASTIC MOLDINGS OF THE SPI

I.C.I. PLASTICS

Serve the Shopfitter



A revealing example of the way in which plastics play their part in modern shopfitting is this new Sainsbury* self-service store at Eastbourne. Versatile, shatter-proof 'Perspex' sheet—clear and coloured—is put to good use in the counter display shields, the windows and surrounds of the refrigerated cabinets, and the egg and tea containers. The diffusing covers of the fluorescent lighting units are in opal 'Perspex', while corrugated 'Perspex' has been cleverly used for the egg display racks.

Other I.C.I. plastics at the shopfitter's service include 'Darvic' rigid p.v.c. for display signs and fittings, and 'Mouldrite' phenol and urea formaldehyde moulding powders for robust, colourful moulded products, while there are numberless other display uses for 'Perspex' itself.

* Equipment shown includes material patented, and designs registered, by Messrs. J. Sainsburys.

'Darvic', 'Perspex' and 'Mouldrite' are registered trade marks in the United Kingdom, the property of Imperial Chemical Industries Ltd.

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Plastics Division, Black Fan Road, Welwyn Garden City, Herts, England.

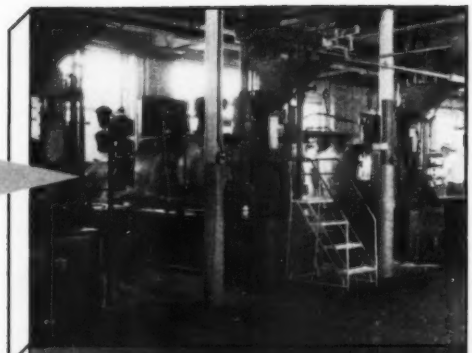
U.S.A. enquiries to:—**J. B. HENRIQUES INC.**, *521 Fifth Avenue, New York 17, N.Y.*

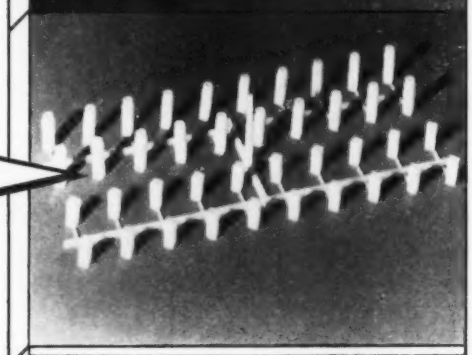
P.545m

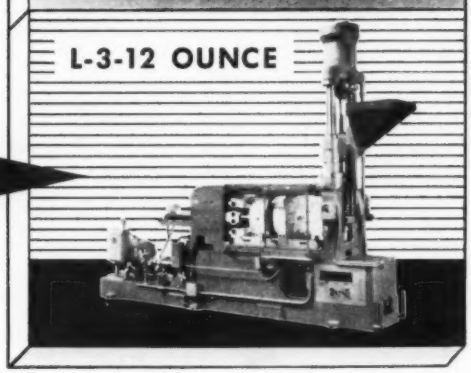
DANIELSON MANUFACTURING COMPANY

100% NYLON

100% LESTER







Up in Danielson, Connecticut, there's a plant where they mold nylon—and nothing but nylon. Day in, day out and all day long they mold nylon. And what do they mold it on? A battery of Lesters!

In 1946, Danielson Mfg. Co., started molding nylon on their first machine. Since that time, Danco has used Lesters exclusively to handle every kind of nylon problem that has turned up.

In the photo above you can see a typically fine shot currently in production—a gate of 40 nylon bearings used on a cotton picker. The clean, sharp end of the sprue is mute testimony to the effectiveness of the Lester Nylon Cut-off Attachment. And for vocal testimony here's what Danco says, "We've had such good results with Lesters, we've made them a standard for our molding equipment. That's why we have three more Lesters on order."

May we send you complete specifications on the Lester Injection Molding Machine to suit your molding requirements?

LESTER INJECTION MOLDING MACHINES

REPRESENTATIVES

New York	Steven F. Krould	Seattle	Perine Machinery & Supply Co., Inc.	**FOREIGN**	
Detroit	Thoreson-McCosh	Cincinnati	Index Machinery Corp.	Toronto, Canada	Modern Tool Works, Ltd.
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Cleveland	Don Williams	San Francisco	J. Fraser Rae	Japan	Okura & Co., New York, Inc.
Coral Gables	Morton Machinery Sales	St. Louis, Milwaukee	A. B. Geers		

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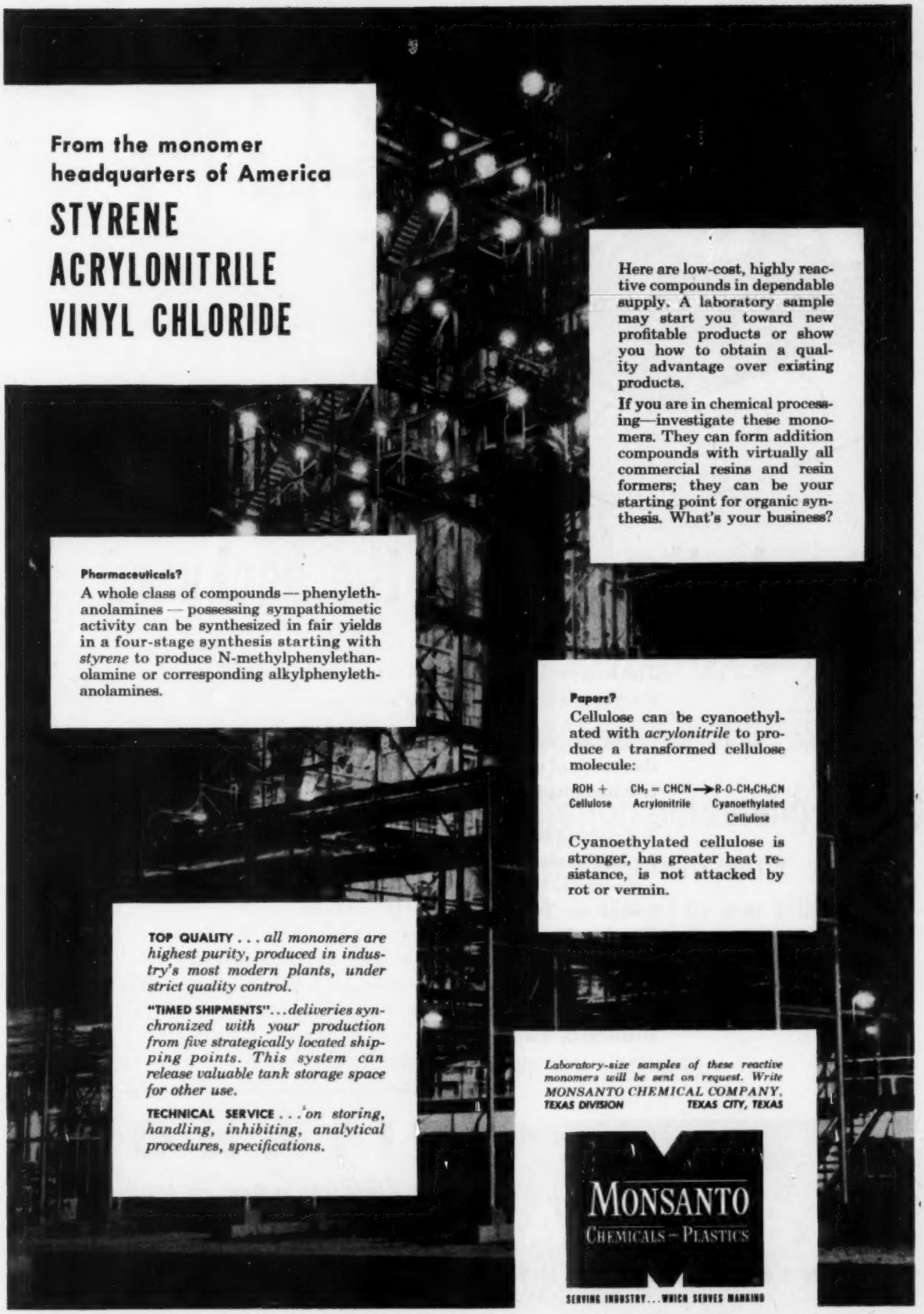


From the monomer headquarters of America

STYRENE
ACRYLONITRILE
VINYL CHLORIDE

Here are low-cost, highly reactive compounds in dependable supply. A laboratory sample may start you toward new profitable products or show you how to obtain a quality advantage over existing products.

If you are in chemical processing—investigate these monomers. They can form addition compounds with virtually all commercial resins and resin formers; they can be your starting point for organic synthesis. What's your business?

Pharmaceuticals?

A whole class of compounds — phenylethanolamines — possessing sympathiometic activity can be synthesized in fair yields in a four-stage synthesis starting with *styrene* to produce N-methylphenylethanolamine or corresponding alkylphenylethanolamines.

Papers?

Cellulose can be cyanoethylated with *acrylonitrile* to produce a transformed cellulose molecule:

$$\underset{\text{Cellulose}}{ROH} + \underset{\text{Acrylonitrile}}{CH_2=CHCN} \rightarrow \underset{\text{Cyanoethylated Cellulose}}{R\text{-}O\text{-}CH_2CH_2CN}$$

Cyanoethylated cellulose is stronger, has greater heat resistance, is not attacked by rot or vermin.

TOP QUALITY . . . *all monomers are highest purity, produced in industry's most modern plants, under strict quality control.*

"TIMED SHIPMENTS" . . . *deliveries synchronized with your production from five strategically located shipping points. This system can release valuable tank storage space for other use.*

TECHNICAL SERVICE . . . *on storing, handling, inhibiting, analytical procedures, specifications.*

Laboratory-size samples of these reactive monomers will be sent on request. Write MONSANTO CHEMICAL COMPANY, TEXAS DIVISION TEXAS CITY, TEXAS

MONSANTO
CHEMICALS — PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

plastics take to the backyard

The backyard swimming pool is now easily available to everybody's kids . . . thanks to plastics.

Bright, gay, durable colors help sell plastic pools—and thousands of other plastic objects. And that's where TITANOX titanium dioxide pigments come into the plastics picture.

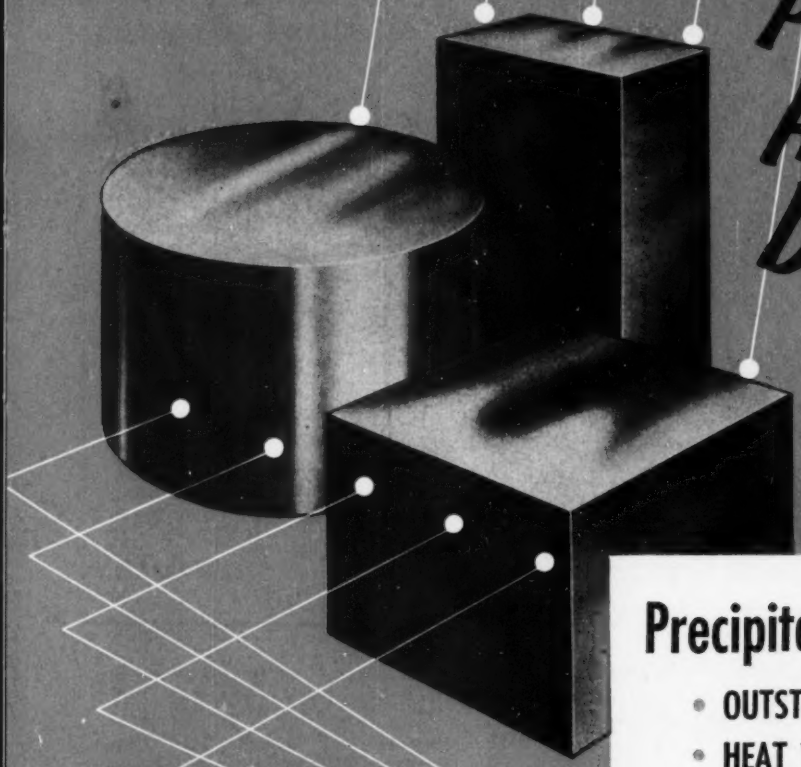
For nothing can compare with titanium dioxide pigments for brightening, whitening, opacifying or beautifying plastic compounds. If you have a plastic pigmentation problem, consult our Technical Service Department.
Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7.
In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

®TITANOX
the brightest name in pigments

TITANIUM PIGMENT CORPORATION
Subsidiary of NATIONAL LEAD COMPANY

Cascade

Precipitation Hardened Die Steel for Plastic Molds



Precipitation hardening means

- OUTSTANDING FINISHABILITY
- HEAT TREATMENT by user ELIMINATED
- GOOD MACHINABILITY
- BEST WELDABILITY
- HIGH STRENGTH
- UNIFORM HARDNESS

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LATROBE
STEEL COMPANY
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Write for complete metallurgical data today!

What's Screwy?

by Phillips

"Very fancy, dear, but wouldn't it be cheaper to use Phillips Cross-Recessed-Head Screws?"

PERFECTLY MATED! Only Phillips Drivers are perfectly mated to Phillips Screws. Look for the name Phillips on the shank.

FREEDOM FROM DRIVER SKIDS is just one of the advantages of Phillips Screws. No danger of marring the finish. In addition, they drive in much faster. And they add to the structural strength of the product, too — set up tighter and resist loosening under vibration.

The identifying X on the cross-recessed-head identifies the X-tra quality of Phillips Screws at a glance. Be sure to specify "Phillips."

PHILLIPS *Cross-Recessed-Head* SCREWS

X *marks the spot... the mark of extra quality*

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TODAY'S...AND THE FUTURE'S...FINEST FASTENER

The Ideal Plastic

CHEMICAL PROBLEM...

. . . a leading toymaker wanted a tough, high-quality plastic that would withstand frequent handling and hard use by children, yet could be economically and easily formed into a realistic, mass-produced doll.

SOLUTION...

. . . Hercocel® A, Hercules' cellulose acetate molding powder. Low in cost, and noted for its impact strength and moldability, this super-tough thermoplastic permits intricate detailing in the doll's movable head, arms, and legs and is easily lacquered to obtain lifelike coloring.

RESULT...

. . . Ideal's Saucy Walker, the fastest selling doll of its class in toy retailing history. More than 350,000 were purchased in 1952, and the manufacturer anticipates the 1953 demand will exceed 500,000. For high-quality, fast-moving merchandise of all types—including housewares, fashion accessories, tool handles—more and more manufacturers are turning to low-cost Hercocel A. Write Hercules for details.

Ideal Toy Corporation's Saucy Walker doll, molded with Hercocel A, is available at better toy departments

Hercules' business is solving problems by chemistry for industry . . .

. . . rubber, insecticides, adhesives, textiles, paper, plastics, paint, varnish, lacquer, soaps, detergents, to name a few, use Hercules® synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products and other chemical processing materials. Hercules® explosives serve mining, quarrying, construction, seismograph projects everywhere.

HERCULES

HERCULES POWDER COMPANY 916 Market Street, Wilmington 99, Del.
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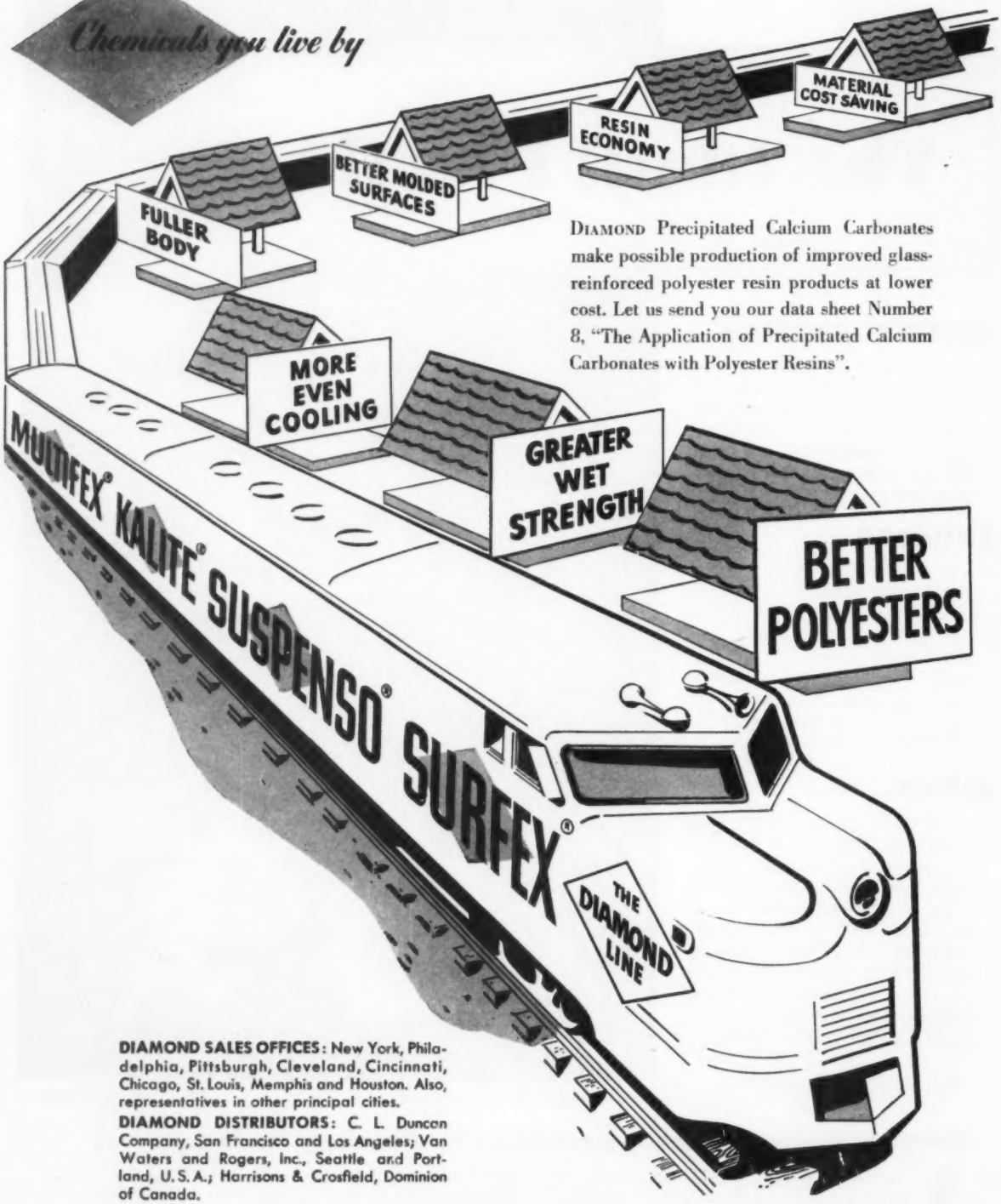
Chemicals you live by



DIAMOND Precipitated Calcium Carbonates make possible production of improved glass-reinforced polyester resin products at lower cost. Let us send you our data sheet Number 8, "The Application of Precipitated Calcium Carbonates with Polyester Resins".

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Ride the DIAMOND Line to Better Polyester Products

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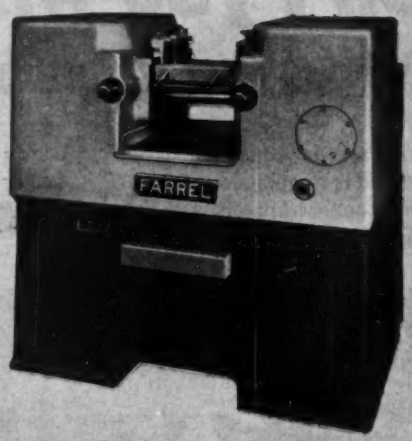
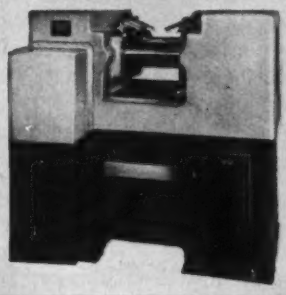
DIAMOND ALKALI CHEMICALS®

One of these FOUR DESIGNS may be just THE LABORATORY MILL you need

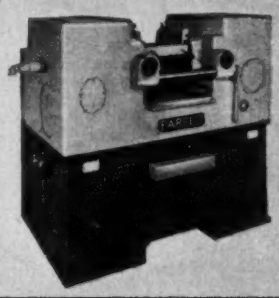
1 — FRONT VIEW



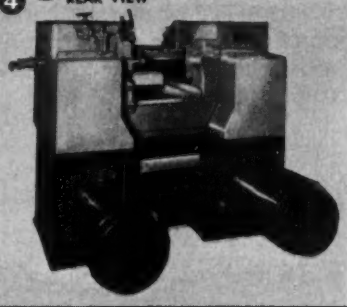
2 — REAR VIEW



3 — FRONT VIEW



4 — REAR VIEW



	Method of Speed Control	No. of Motors	HP Each Motor	Friction Ratio	Roll Speed (RPM) Front	Back
1	Constant	1(AC)	7½	1.4:1	23.5	33
2	Vari-pitch Pulley	1(AC)	7½	1.4:1	13 to 24	18 to 34
3	Vari-pitch Pulleys	2(AC)	5	Variable	20 to 38	18 to 34
4	Variable Voltage	2(DC)	5	Variable	4.5 to 34	6 to 45

Here is a standard, two-roll, 6″ x 13″ laboratory mill, which you can have with four different drive arrangements. One of these should give you exactly the roll speed, or speeds, and friction ratio you need for your experimental work.

Drive may be (1) by single AC motor with mill gearing to give constant roll speed and 1.4:1 friction; (2) by single AC motor driving the rolls through vari-speed sheaves to give a back roll speed range of 18 to 34 RPM and 1.4:1 friction; (3) by two AC motors with vari-speed drives for friction ratios from even speed up to 2.1:1; (4) by two DC motors with variable voltage control for ratios from even speed up to 10:1 friction.

Standard mills have self-contained automatic cascade lubrication, swinging scraper, tilting guides and knee-operated safety trip. Optional features include chrome-plated rolls, extra hand scraper, air-operated scraper, ratchet roll adjustment, and batch-off roll.

Send for further information about this versatile mill. Or, if you prefer, a Farrel-Birmingham engineer will be glad to discuss your laboratory equipment problems with you at any time.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston
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Farrel-Birmingham®

Don't you wish *you could say these things about your presses and your power source?*

"We operate seventeen modern downstroking compression presses in the identical space formerly occupied by 11 *obsolete* presses."

"Once we set a cycle, no matter how complex it may be, it is reproduced exactly, at just the push of a button."

"Within two-and-a-half seconds, our presses can close, apply 60-tons clamping pressure, and start to transfer the material."

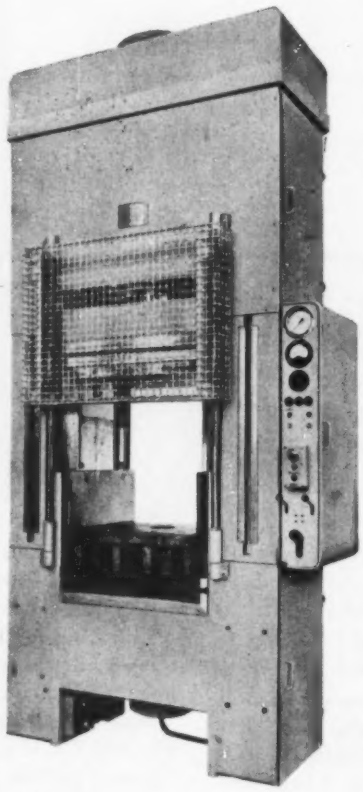
"We have one inexpensive, *flexible* power source which gives us a choice of three working pressures per press."

"In over twelve months' operation, we have never had a breakdown in our medium-pressure-plus-intensifier system that caused a production stoppage of more than ten minutes . . . And few of those."

"Thanks to the fast cycling of our presses and their low reject rate, our production is up almost 15%."

"Our eighteen 150-ton presses operate continuously with cures ranging from 35 seconds to 2 minutes. Yet, a double pump unit with one 10 and one 15 h.p. motor supplies all the power we can use."

You can *if you install Bipel "auto-control" presses and central power units.*



Wherever Bipel presses and power units have been installed, they have established new *higher* standards for fine compression and transfer molding. The Bipel Type 40 press operates at 20, 40, or 60 tons pressure; the Type 100, at 50, 100, or 150 tons; the Type 200, at 100, 200, or 300 tons.

Being complete molding machines, compactly built, better designed and engineered in every detail, they produce consistently *superior* moldings than conventional four-column presses.

With the unique Bipel drive system, high pressure is generated within the press itself and its use is confined, in a closed circuit, to the final application of molding pressure. Therefore, the pumps require less horsepower, the piping needs less thickness, and the valves and other components are lighter and less expensive to purchase, to install, and to operate.

We are certain that additional details will further prove the ability of Bipel presses and power drives to increase your profits significantly. Your request will be answered promptly.

Address American inquiries to
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B·I·P GROUP

B. I. P. ENGINEERING LTD.

Aldridge Road, Streetly, Staffordshire, England

for superior light fastness and flushability

HELIOGEN® PRESSCAKES

phthalocyanine blues and greens of exceptional brilliance and workability

Clear, clean, brilliant HELIOGEN Colors are the finest nonfading blues and greens available today... always in demand where quality comes first.

Heliogen Blue BDV Presscake	Heliogen Blue BNC Presscake Special	Heliogen Blue BG Presscake Special	Heliogen Green GB Presscake Special
Dark, transparent mass tones	Stable dimensionally	Peacock blue shade	Bluer shade, with added strength
Crystallizing type	Noncrystallizing	Noncrystallizing	Noncrystallizing
No surfactants	No surfactants	No surfactants	No surfactants
Nonbleeding	Slight bleeding	Nonbleeding Heat resistant	Nonbleeding
24% dry content (approx.)	25% dry content (approx.)	40% dry content (approx.)	29% dry content (approx.)
FOR FLUSHING IN:			
Oil base paints Plastics Printing inks Varnishes Textile printing	Plastics Printing inks Varnishes Textile printing Rubber base paints	Oil base paints Plastics Printing inks Varnishes Textile printing Rubber base paints Baking enamels Enamels	Oil base paints Plastics Printing inks Varnishes Textile printing Rubber base paints Baking enamels Enamels

For more complete information on HELIOGEN colors, send for our handsome free booklet.

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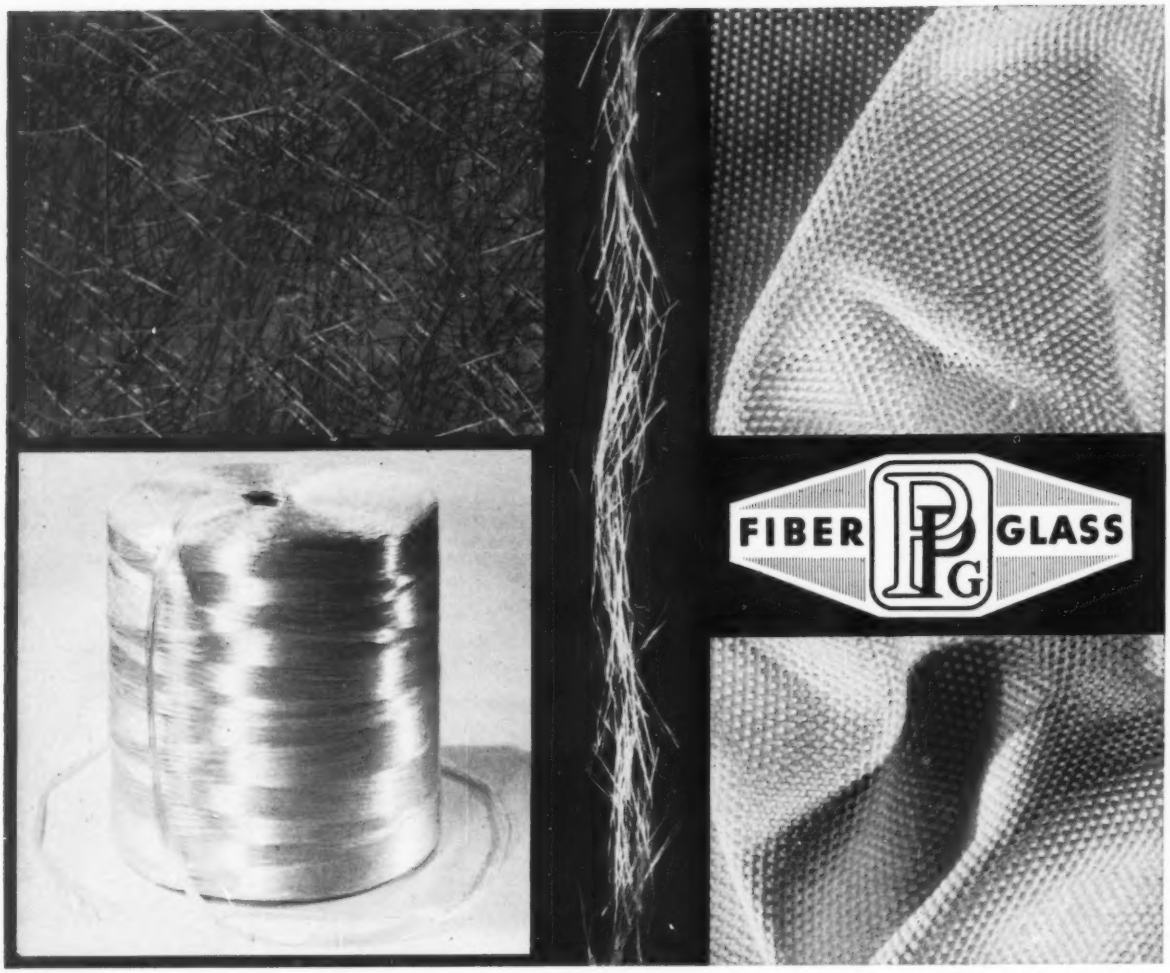

Uniformly high quality in plastics reinforcements

Today's rapidly growing applications of reinforced plastics call for reinforcements of exceptional uniformity in the molding process. Now, at the nation's newest glass fiber plant, such uniformity of glass fiber filaments is a reality—the result of extremely accurate manufacturing controls created from the 70 years' experience in glass making of Pittsburgh Plate Glass Company.

To you, as a molder, this uniformity means better laminating results and, most important, better product quality in all of your reinforced plastics molding.

Pittsburgh Fiber Glass reinforcements are readily available as roving (made from 140's yarn size), or as chopped strands (also 140's yarn size) cut to standard lengths from ¼" to 5". You can also obtain Pittsburgh Fiber Glass in the form of reinforcing cloth or mats from reputable weavers or manufacturers whose names we will supply upon request.

Prove Pittsburgh's high quality to yourself by arranging for tests today through our executive offices or district sales offices in Chicago, Cincinnati, Cleveland, Detroit, New York or Washington. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.

Write today for your copy of a new folder describing Pittsburgh Fiber Glass plastics reinforcements. Address your request to our executive offices at Pittsburgh.

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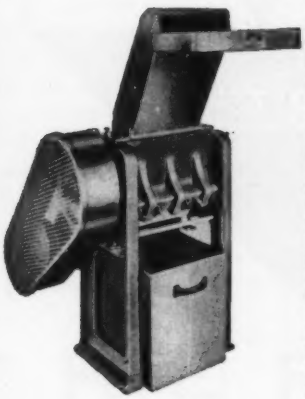
PITTSBURGH PLATE GLASS COMPANY

Save time, money, storage space with—

DE MATTIA GRANULATORS

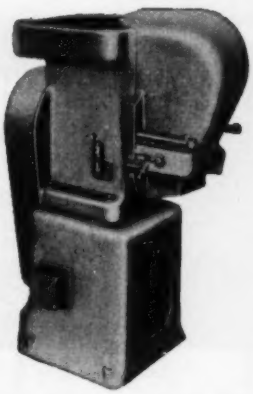
PROCESS ALL YOUR SCRAP

GRANULATOR No. 1



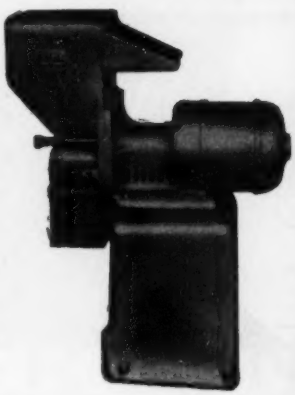
Simple, rugged and highly efficient. Has capacity of 200 lbs. per hour. 3 H.P. Motor with double V belt and Meehanite flywheel. Features high grade roller bearings with positive seal. Four cutting blades placed on a bias permit efficient cutting of thin strips in Vinyl, Saran, etc. Standard screen with ¼" openings (other screen sizes on request). Floor space required 32" x 44"; net weight with motor (approx.) 800 lbs.

GRANULATOR No. 3



For low-cost salvage of the large slugs and chunks resulting from cleaning out the heating cylinder, accumulation at the nozzle and also those molded pieces too tough for the average sprue and scrap grinder. Capacity — Over 150 lbs. per hr. 3 H.P. Motor in Base. Double V Belt Drive. Heat treated Alloy Steel Rotor High Grade Roller Bearings with Positive Seals. Standard Screens with 11/32" Openings (other sizes on order).

GRANULATOR No. 4



Recommended for at-the-machine operation. Available with or without base. Capacity 75 lbs. per hour; 2 H.P. Motor 1200 RPM; Direct spline drive; Solid semi-steel hopper; High grade roller bearings with positive seals; Standard screen with 11/32" opening; Overall dimensions 34" long, 12" wide, 23½" high (from bench); Hopper opening 9" by 4½"; Net weight 375 lbs. without base; 500 lbs. with base.

DE MATTIA MACHINE and TOOL CO.

DE MATTIA MACHINE and TOOL CO.

CLIFTON • NEW JERSEY

You saw this ad in Tool Engineer, Machinery, Modern Machine Shop, American Machinist, Iron Age.

and CRUCIBLE MOLD STEEL is TOOL STEEL

You profit because mold steels are tool steels at Crucible. Our reputation as specialty steel leaders was built with tool steels.

That means you get all the experience of more than half a century of tool steel leadership when you buy mold steel from Crucible.

Crucible mold steel *is* better—because it's tool steel. And you'll find mold steel stock in strategically located warehouses from coast-to-coast.

WRITE TODAY FOR YOUR TOOL STEEL SELECTOR

Get your copy of the unique Crucible Tool Steel Selector — a quick twist of the dial gives you the right tool steel for the right job. And the selector picks mold steel, tool 9-inch diameter; printed in 3-colors.

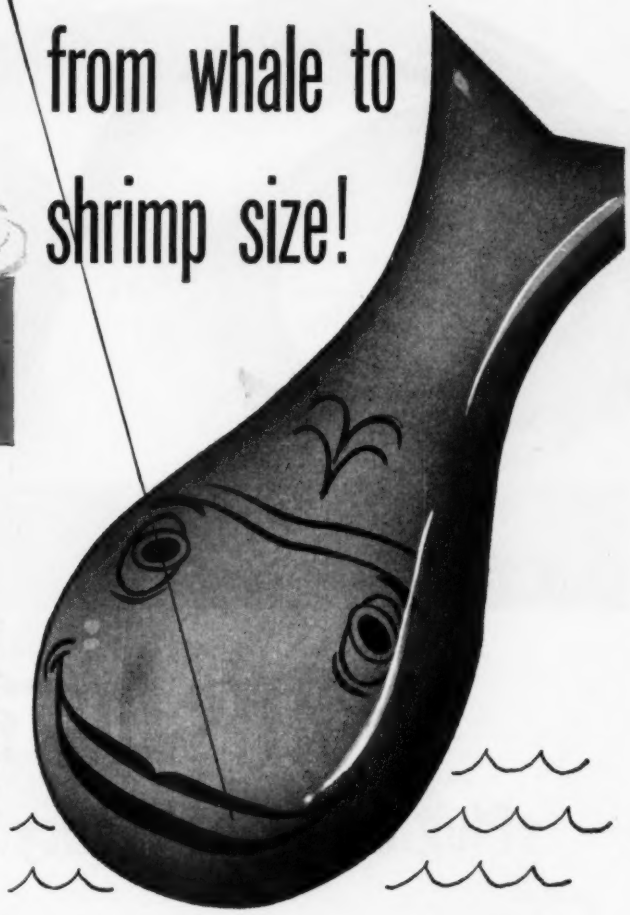
CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking

MOLD STEEL

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

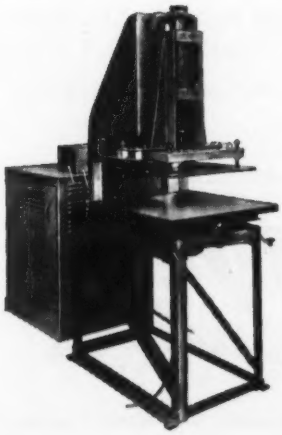
Weld vinyl from whale to shrimp size!



don't let the BIG ones get away!

Electronic heat sealing isn't limited to smaller items. Plastic wallets, toys, bags, place mats, etc. tell only half the story. THERMATRON generators and presses are also available to tackle the *big* jobs – wading pools, boats, life rafts, air mattresses, large inflated toys and the like – with amazing speed and strength. THERMATRON *welds* plastics, doesn't stitch, producing permanent seams stronger than the material itself . . . eliminates perforations, rips and tears!

THERMATRON



Vinyl plastic products are bigger than ever, in more ways than one, and your idea needn't be limited by size. For example, the THERMATRON P-16 Press may be had with bed sizes up to 25" x 60" providing convenient access to the press on three sides. THERMATRON high frequency generators from 6KW to 20 KW are available from stock . . . and custom jobs can be built up to 100 KW.

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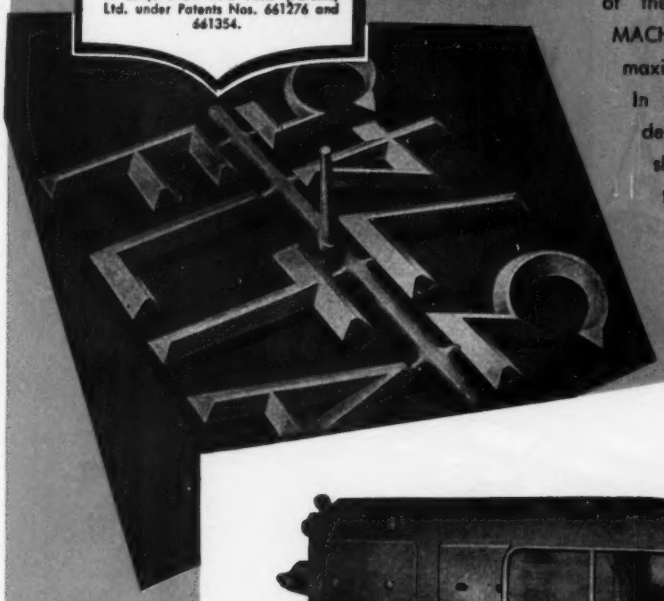

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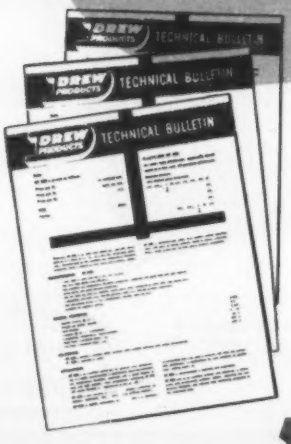

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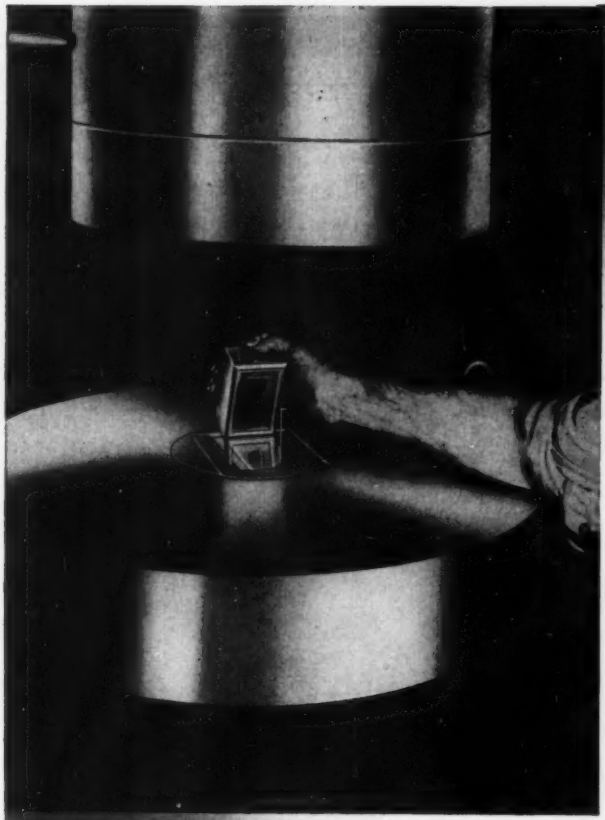

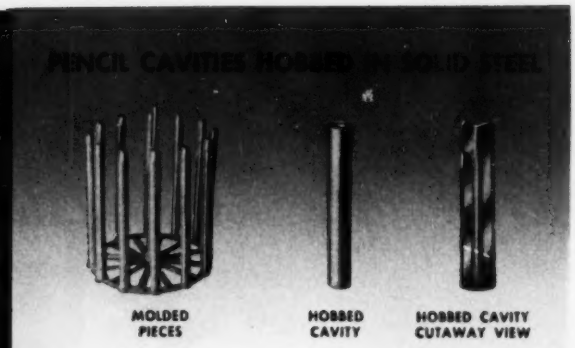

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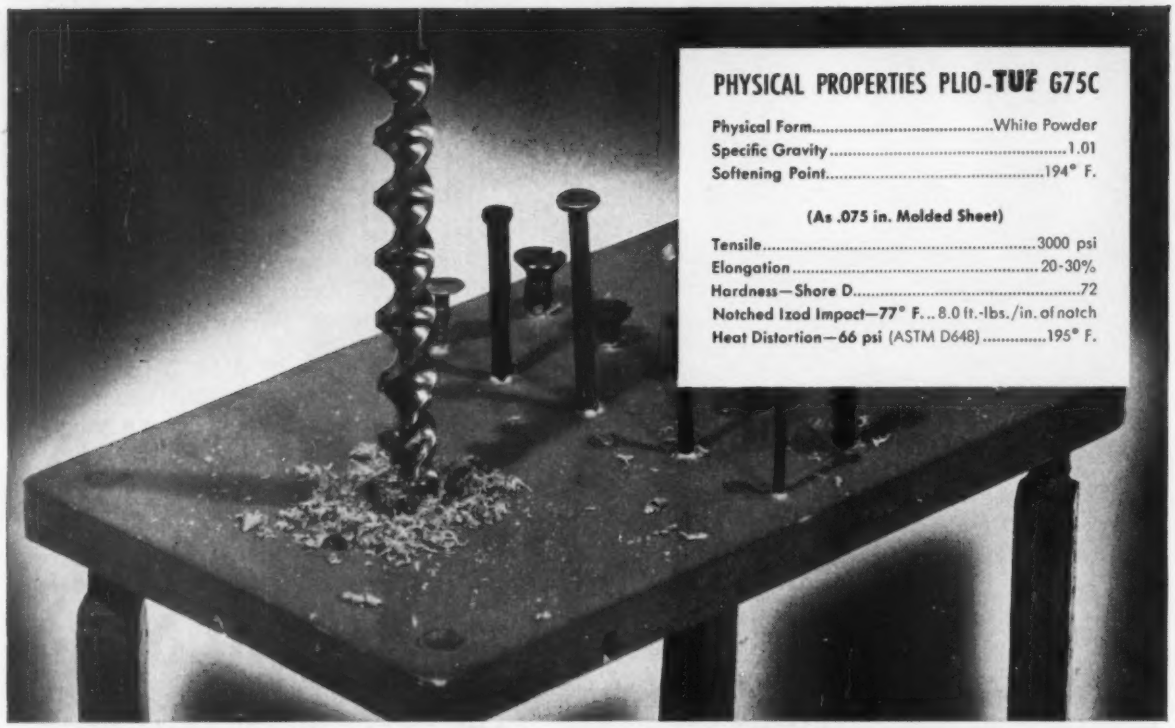

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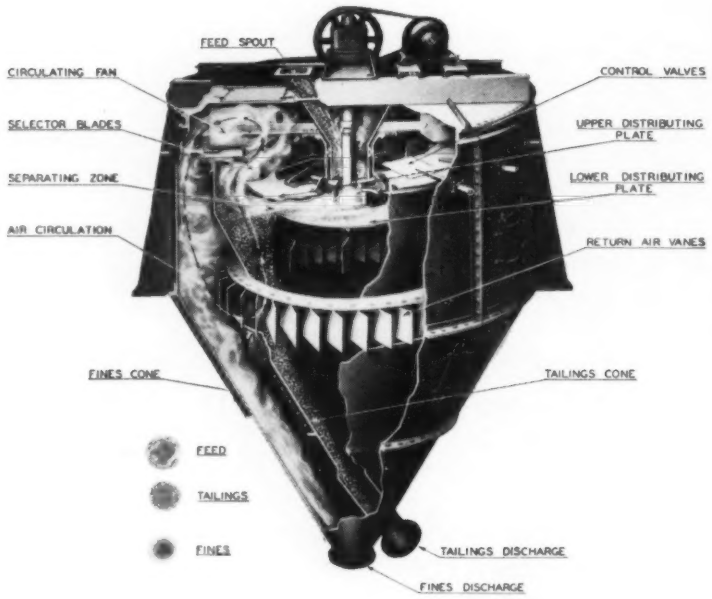

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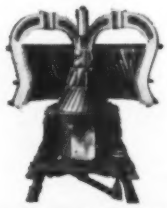

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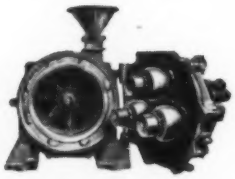

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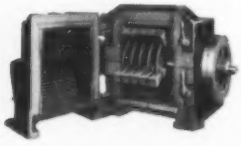

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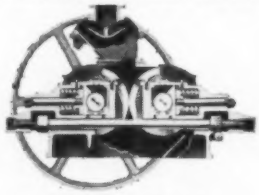

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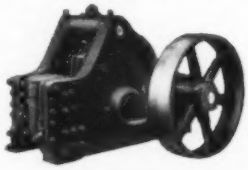

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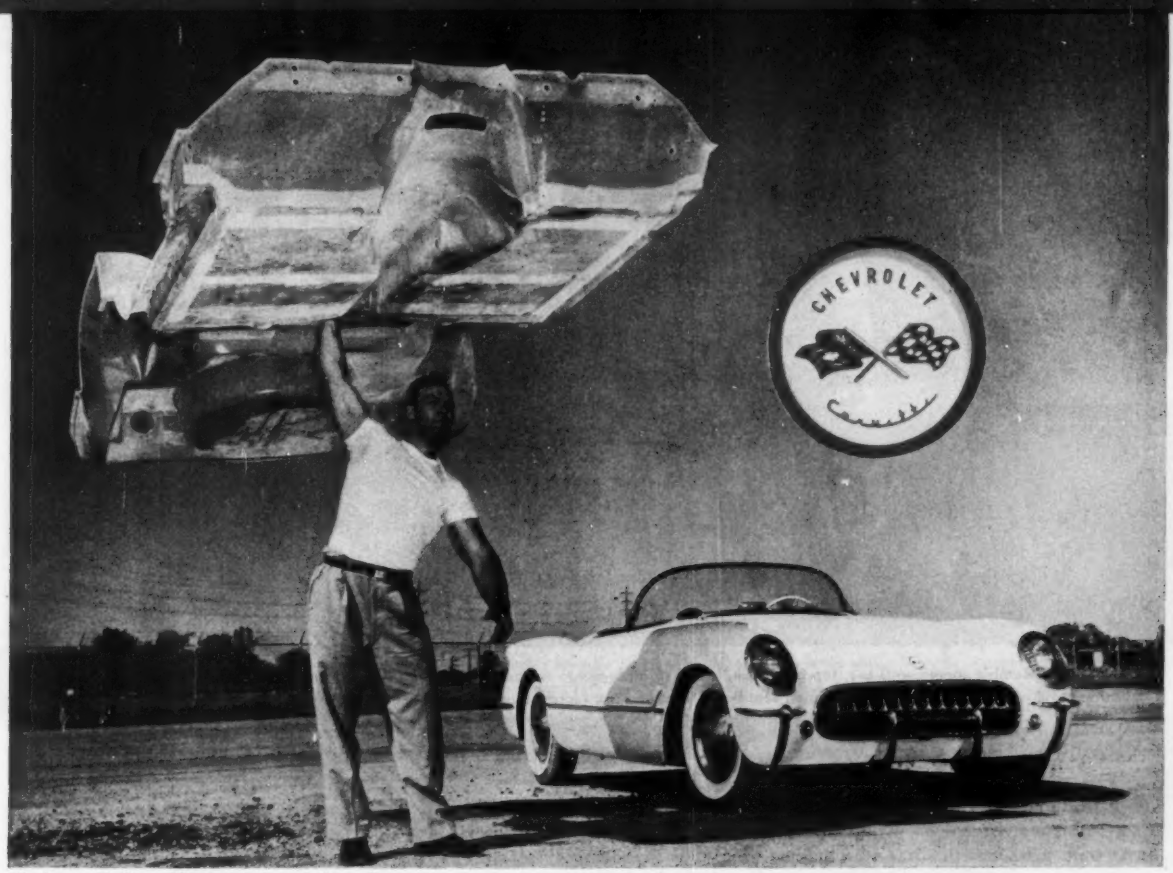
MODERN PLASTICS

DECEMBER 1953 VOLUME 31 NUMBER 4



All photos with this article courtesy General Motors Corp.

Extending from rear bumper to dash, reinforced plastics underbody of the Corvette measures 9½ by 6 ft., weighs only 75 pounds

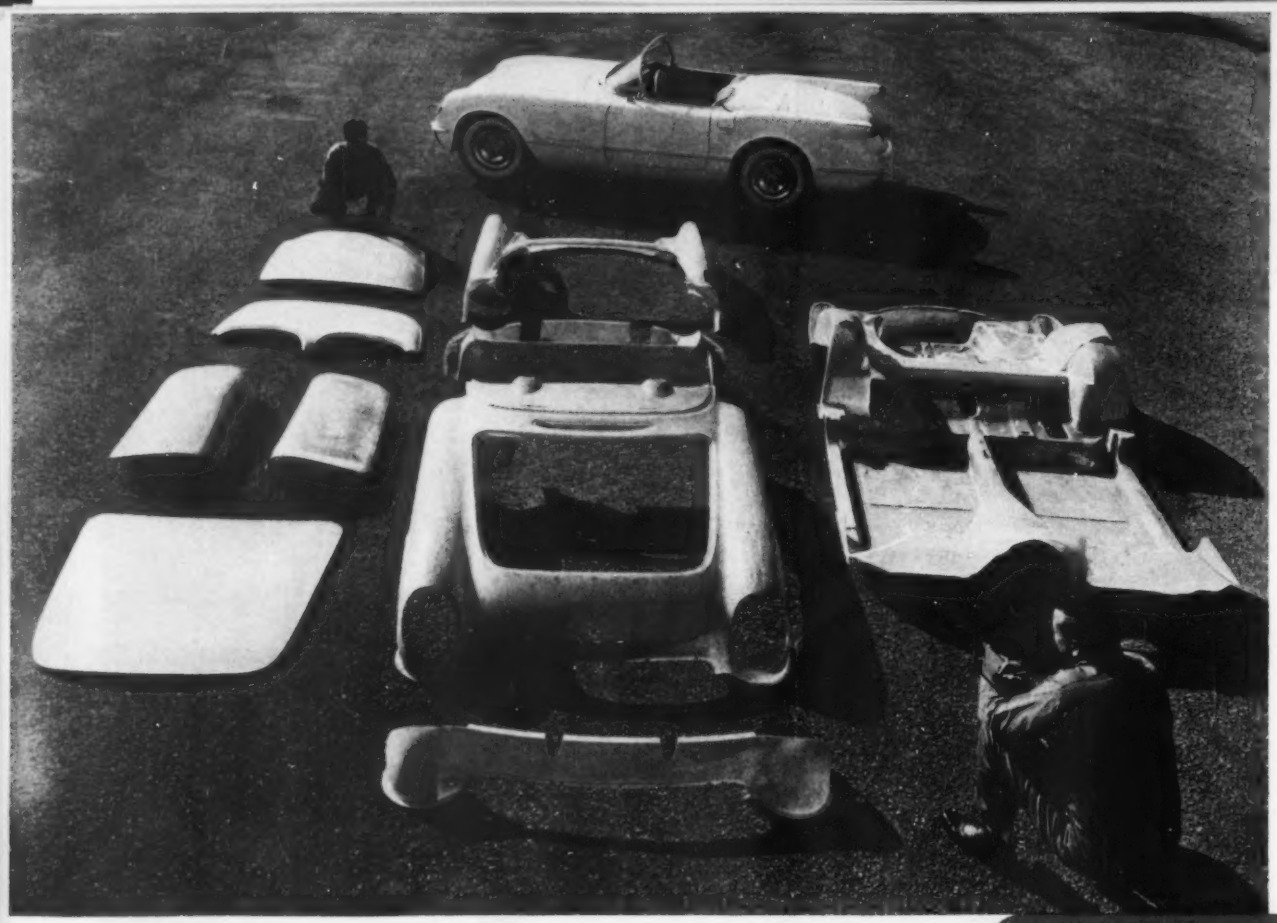
HERE COMES THE CORVETTE!

Chevrolet sports cars with reinforced plastics bodies are rolling off the assembly line at an accelerating pace

FIRST production line to be set up by a major U.S. car manufacturer to turn out automobiles using plastics bodies is now in operation at Flint, Mich.; and the handling ease of the car, its remarkable acceleration, and its uncanny ability to hug the road on tight turns at high speeds are being proved at the big General Motors proving ground at Milford, Mich. The car is the new Chevrolet Corvette sports model. Opening of the production line heralds the volume adoption of reinforced plastics by the automotive industry.

The car has an over-all length of 167 in., a body height of 33 in. at the door, and a curb weight of 2850 pounds. Despite its very low center of gravity, gained in part through the use of the plastics body, it has a road clearance of six inches.

Previously, most automotive bodies of reinforced plastics construction which have been built here have been handled on an experimental or prototype basis, or produced by independent body firms for custom installation on a modified standard chassis (MODERN PLASTICS, February, 1953, p. 75ff). With Corvettes now



Major plastics assembly components are, top to bottom, left to right: luggage compartment lid, folding top compartment lid, doors, hood; rear fender panel, seat back, front and front lower fender panels; underbody

PARTS

rolling off the assembly line, reinforced plastics move into a new and important position in the automotive industry.

Prototype

The original prototype Corvette, exhibited last winter at several auto shows to sample public reaction was constructed of fibrous glass, laminate primarily because of the speed and facility with which the material could be molded without costly, time-consuming tooling. This show model was so enthusiastically received that it was decided to place the car in limited production. Projected production, tooling up costs, tooling period, and such intangible factors as the "glamour appeal" of fibrous glass-polyester laminates, all were in favor of a plastics body. Tools were designed and ordered. The initial step was the construction of wooden die models for the molds.

Preliminary experimental work with reinforced plastics bodies involved a standard 1952 Chevrolet convertible which was used as a mold for the original plastics body. Laminated reinforced plastics panels were built over sections of the convertible body to produce a female mold, which in turn was utilized in making hand lay-ups of the finished plastics parts. Assembly of the parts then gave a duplicate of the original steel convertible body in plastic. Mounted on a stock Chevrolet chassis, this experimental body withstood many severe tests.

Break-Over Point

Calculations by Chevrolet engineers and production men set 15,000 cars as the break-over point where, from the cost standpoint alone, it would be economical to make the body of sheet steel instead of reinforced plastics. This is predicated on the fact that for long production runs, the much heavier initial tooling costs required for sheet metal construction can be justified because the steel bodies can be made more rapidly than those of reinforced plastics, yielding a lower unit cost. It does not, however, make any allowance for the relative advantages of the plastics bodies to the buyer, in terms of design, performance, or longer service life. Nor does it mean that the 15,000 figure might not be changed later by reason of improved manufacturing techniques.

Weighing approximately 410 lb. (in comparison to an estimated 600 lb. in sheet steel), the Corvette's body includes a total of 41 fibrous glass-polyester parts, of which some 17 are listed as major assembly components. Currently, tooling is in a transitional stage and several types of molding processes are being used, ranging from the bag method and hand lay-ups to matched metal molds. At present, 61 individual molds are used in the production of Corvette body sections. By the time that output is stepped up early next

year to a projected 30 cars per day in an assembly plant now being readied at St. Louis, it is expected that all molding will be done with matched metal dies. This method is now being used in producing the instrument panel or dashboard section, where the quality of the finish is particularly important.

Tool Costs

Chevrolet engineers state that the total tool cost for the Corvette body, including the necessary molds, will run approximately $500,000, as compared to an estimated $4,500,000 if the body had been made of sheet steel. Adoption of the plastics body not only made possible this tremendous saving in tool costs, but also enabled the Chevrolet Div. to get the car into production in only a fraction of the time required with a metal body. To date, approximately 100 of the cars have been made and the present rate of production is three Corvettes daily. Much of the speed and flexibility of the initial tooling was made possible through the use of cast phenolic dies for some parts and epoxy-fibrous glass molds for other body components.

Actual molding of the reinforced plastics parts is now divided between the new General Motors Technical Center at Detroit and a molding plant in Ashtabula, Ohio. Following completion of new plant facilities at Ashtabula, all molding will be performed there, with the parts shipped to St. Louis for final assembly.

Features

Some of the outstanding features of the Corvette reinforced plastics body are as follows:

The panels permit lighter weight without sacrificing over-all body strength, resulting in increased economy of operation. Total weight of the body is about two-thirds that of a metal body of equal size. Plastics bodies are more resistant to shock; a blow that would dent steel bounces harmlessly off the reinforced plastic. Damage to a plastic body is localized and breaks in the body surface can be repaired or complete panels replaced without the services of highly skilled labor. The body requires no rust-proofing or undercoating, since the plastic surfaces are impervious to deterioration by water. It is also freer of "drumming" and the possibility of squeaks and rattles, since metal-to-metal contacts have been eliminated. Plastics are not as retentive of heat as steel; the Corvette standing in a hot sun still remains at relatively low temperatures.

From a manufacturing standpoint, Chevrolet cites both advantages and disadvantages for the reinforced plastics body. The low weight of the material promotes ease of material handling, and the body sections are not readily subject to damage in transporting and assembly. One man can lift a major body section without effort and two can carry a complete body shell. The forming of plastics does not require heavy stamping presses. The quick molding of parts affords a short cut in primary design processes, a field

AND PLANT

Assembly of cars starts with placing frame on chassis; axles, springs, wheels, and engine are added before body drop; seats are installed after body is attached to chassis

MODELS AND MOLDS

Initial step in production of reinforced plastics car body is construction of necessary die models for molds; above is mahogany die model for underbody mold

Glass mat is cut to fit rear section of underbody mold, will be resin-impregnated before second lay-up

that is already playing an important part in experimental engineering.

Although the fabrication of plastics bodies now requires more labor and greater floor area than steel bodies, recent developments at least show promise of eventually fitting manufacture to the "station" system that is the real key to production efficiency. In this system, perfected by the automotive industry, the workman produces in volume exclusively at one machine or at one point along the assembly line.

The remarkable ability of the plastics body to absorb punishment has been convincingly demonstrated at the proving ground by two unscheduled collisions involving Corvettes and other cars of conventional construction. In both cases, the sleek sports car emerged practically unscathed, while the metal bodies sustained extensive damage. In the Belgian block road tests, where cars are deliberately driven over rough road surfaces which in a few hours inflict more wear and abuse than years of normal driving, the Corvette's performance has been better than that of any metal-bodied car tested by Chevrolet.

Differentials in the coefficient of expansion between the fibrous glass body and the metal frame of the car have not proved to be a problem in the Corvette. This differential is so small that it is not even necessary to make any allowance for fore-and-aft expansion of the body, which measures almost 14 ft. long. Water absorption, likewise, is so negligible that Chevrolet engineers state it has caused absolutely no difficulty with the painted finish of the car. The body has also been tested in extremes of temperature with no unfavorable results, including cold room and shock tests down to —25° F. Continuing exposure tests are now in progress in Arizona, Florida, and Alberta, Canada.

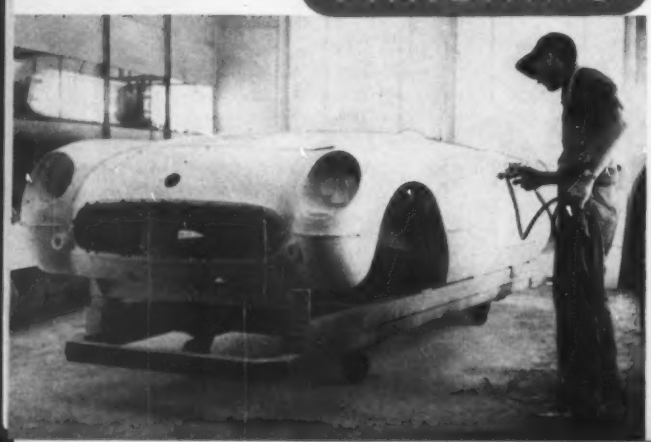
In translating the original Corvette prototype into a production car, Chevrolet engineers took advantage of the fact that with a reinforced plastics body, certain design treatments could be used which would be virtually impossible to duplicate in sheet metal. An excellent example is the Corvette tail lamp housings, with their distinctive finned design.

Panel Split-Ups

To facilitate production of the car, panel split-ups were arranged to provide a main horizontal joint along each side of the body, which could be made structurally strong and concealed by a chrome trim molding. Exhaustive specifications prepared for the various types of polyester resins used cover numerous characteristics, including high heat resistance (chlorinated resins are used), hot and cold strength, water resistance, and fast curing time. The finished body is approximately 60% polyester resin and 40% fibrous glass mat or cloth.

An interesting construction fea-

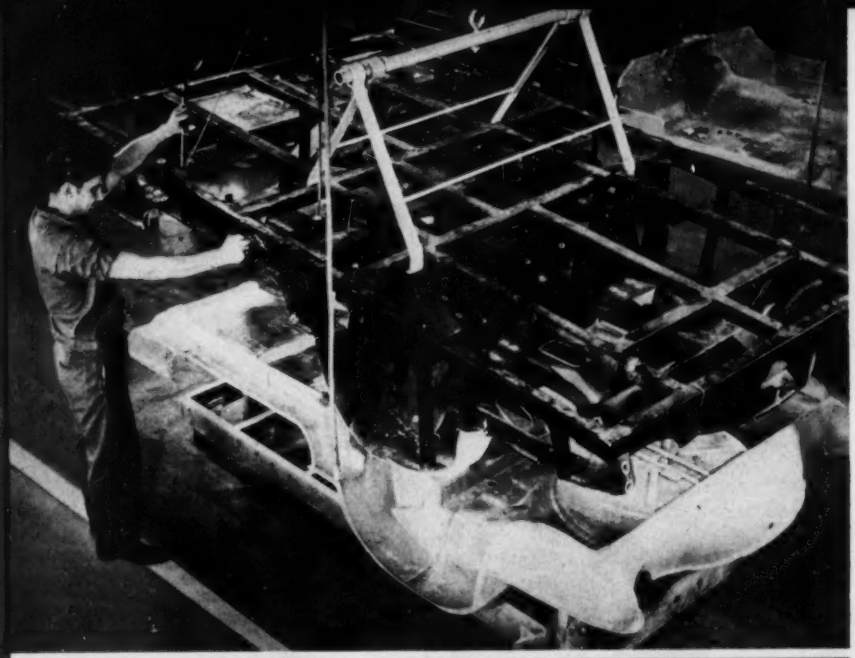
FINISHING



Body shell is spray-painted to mask glass fibers; after final coat has dried, shell will be trimmed and wired

JIGS AND ASSEMBLY

Drill jig is lowered over Corvette reinforced plastics underbody to furnish guide for locating holes for rivets which will secure body to frame

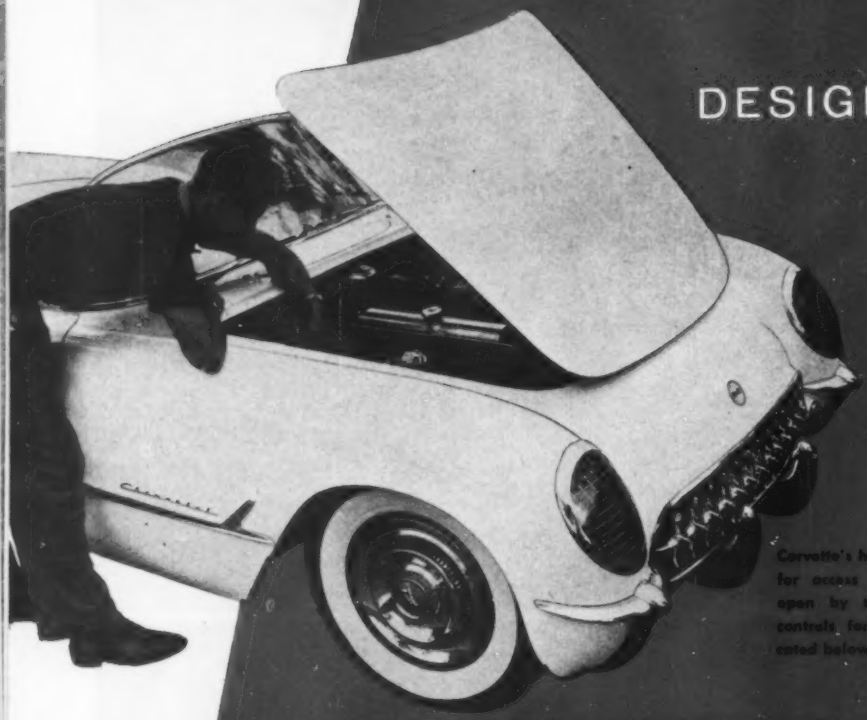


After the Corvette's underbody has been fitted with instrument panel and lower portion of seat back, the front top section of the body is assembled to it

Frame for right housing mounts on fender in perfect fit; instrument spare wheel well is molded as integral part of underbody

Though only a small part, tail pipe duct—for support and insulation of tail pipe—is formed in intricate, three-piece box mold

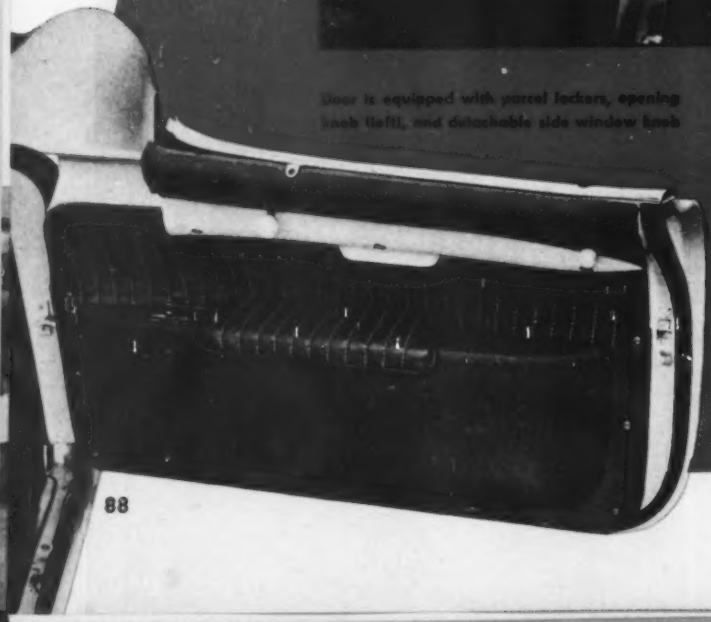
DESIGN DETAILS



Corvette's hood, hinged at front for access to engine, is held open by telescoping support; controls for hood lock are located below instrument panel

Gas tank, holding 17 gal., installed behind seat back and below folding top compartment, is reached for filling through hinged door on left side of car

Button on panel separating two Corvette seats opens lid covering folding top well. Top is removable; rear bow clamps fit bushings visible on lid



Door is equipped with parcel lockers, opening knob (left), and detachable side window knob

ture of the Corvette body is the use of a large underbody section, measuring 6 by 9½ ft. in size and weighing only 75 lb., which forms the basic floor of the car and extends from the rear bumper through the dash. Incorporation of this part—the largest reinforced plastics component in the entire car—provides a foundation to which other body sections may be joined and results in a very rigid assembly. The horizontal spare wheel well, conveniently located beneath the luggage compartment, is an integral part of this section.

The underbody itself is molded in eight separate parts in epoxy-fibrous glass molds backed up with plaster, using the hand lay-up method. Wooden die models were used in the production of the male and female forms. After the parts have been molded, a scarf edge is made for the 2-in. overlaps between the sections and they are assembled in a master form, joined by means of polyester cement. Metal inserts are molded directly into the underbody section at those points where it will be riveted to the specially designed box girder frame of the car.

Some of the other major body sections of the Corvette include the front end, the rear fender top panel, bulkhead and seat back, instrument panel, hood, luggage compartment lid, and door panels. Under the bag method presently being used for production of most of the body parts, the interior surface of the mold is first sprayed with a parting agent. This is followed by application of Gellcoat, which dries to milky whiteness and produces the smooth exterior surface of the finished part. Next comes the lay-up, consisting of three layers of fibrous glass mat, the first two of which are coated with resin. A back-up mold is then placed in position over the lay-up and pressure exerted by clamping a polyvinyl sheet over the mold and exhausting the air between the sheet and the back-up mold. Heat is applied to hasten the curing process, augmenting the exothermic heat produced by the resin itself. Upon removal of the finished sections from the mold, edge flash is band sawed and finished dimensions are obtained through the use of an abrasive wheel.

Cast Molds

On some of the smaller, more intricate parts, cast phenolic molds are used. An example is the three piece box mold used for forming the Corvette tail pipe ducts. Here the lay-ups of **fibrous glass mat** and resin are placed inside the mold base around a removable core and the box base capped with a mold ram, which is the top section of the die.

At the present assembly plant at Flint, body assembly is located in the center of the building, flanked by the chassis line on one side and paint booths on the other. In the

Unusual for sports cars is spacious rear luggage compartment; lid is spring loaded and counterbalanced to remain open without support

Seats are of form-fitting design; panel contains, among other instruments, tachometer (center) and parking brake warning light (above steering column)

body assembly area are the jigs and fixtures in which body parts are joined into two main sections. The major assemblies are then bonded with polyester cement and riveted together, using small steel backing plates where plastic-to-steel contacts may be subject to stress.

The first body assembly operation consists of drilling all necessary openings in the big underbody section. The openings are located by inverting this component and placing over it a drilling jig, also fabricated of reinforced plastics, in which metal inserts serve as guide holes. Using specially designed plastics jigs and fixtures, the Corvette body parts are then drilled and combined into two main sections, with major assemblies bonded with polyester resin and riveted to form the complete body shell. Spring-loaded clamps are used to hold body sections together while the cement is setting. The use of these clamps along the contact flanges of the plastics parts makes it possible to drill openings and drive rivets before curing of the bond joint has been completed.

To facilitate assembly, the Corvette underbody is placed on a wheeled platform or dolly so that it can be moved progressively along the assembly line as parts are added. The entire operation proceeds much the same way as with a metal body, with cementing and riveting replacing the welding used in standard automobile construction. As parts are assembled and the adhesive cures, joints are ground down and sanded so that they become almost invisible—even before application of the prime and finish coats.

The instrument panel, produced in matched metal molds, is not cored in the molding process to accommodate the speedometer, tachometer, and various other instru-

New Concept of

Courtesy Eastman Kodak

Design for Verifax Photo Copier in plastics involved complicated molding but greatly simplified assembly and use

Modern deep molding of plastics was used in developing dehumidifier, all-plastics except for base, handle, refrigeration system

Courtesy Admiral Corp.

THE Chevrolet Corvette reinforced plastics body described in the foregoing article is only one of a recent series of design concepts for plastics which portend not merely a design and manufacturing revolution of a sort, but much bigger markets for plastics.

As recently as 18 months to two years ago the thinking of designers was largely in the direction of the replacement of metal or ceramic or rubber or other non-plastics components with plastics. And selection of plastics materials and determination of designs was based on fractional replacement. Those days are gone, we hope and believe, forever.

The designer of 1953 has learned to consider a given total product in relation to its cost, its assembly, and its functions. And, negating tradition, he has become able to forget that it might be metal or wood or something else—and to design exclusively for plastics. Result: Vastly improved products involving greatly increased use of plastics.

Had it been the purpose of the Chevrolet designers and the molding engineers just to replace metal with plastics, the Corvette would have been a far less efficient proposition from the standpoints of weight,

ments. Instead, the panel is molded solid and openings are fabricated by means of fly cutters and other tools.

Finishing

The body shell of the Corvette is painted "polo white" in a process that duplicates the finishing of steel bodies. After the prime and finishing coats have been sprayed on and dried by batteries of heat lamps, the shell is trimmed and wired in preparation for assembly to the chassis. The painted finish has an excellent bond to the fibrous glass laminate, masks all fibers completely and may be polished with the same type of waxes and other preparations used for standard metal bodies.

Chevrolet engineers made a thorough study of the possibilities of incorporating the final color directly in the resin, eliminating the painting operation, but they feel that the finishes presently obtainable with this method are not sufficiently clear and uniform to meet production standards.

When one considers the various assembly operations through which the body must pass, necessitating constant protection of the surface, it is also questionable whether the use of integral color in the body would produce an ultimate saving in total cost or labor.

The Future

Does production of the Corvette, with its reinforced plastics body, mean that Chevrolet is planning to adopt this material soon for standard passenger car construction?

The Corvette is a special body type with which Chevrolet is studying the market potential for a sports car primarily designed and built for the American market. As a limited production model in which fast tool-

(*Continued on p.* 201)

Design for Plastics

balance, assembly, and maintenance. As it is, it represents a concept designed for reinforced plastics with the various components and tools engineered for practical and economical molding.

The four plastics products shown herewith are results of the same kind of design thinking.

In the Servel Wonderbar, refrigerator designer Donald Daley simply ignored metal tradition. He produced a unit that is beautiful and functional and largely plastics.

The cabinet itself, the outer door, and the control knob are made of phenolic. The inner liner, the front liner, the baffle, the inner door panel, the chill tray, and the escutcheons are made of styrene alloys and copolymers. The tray grids are polyethylene and the latch roller is nylon.

The designer of the Eastman Kodak Verifax Photo Copier didn't clutter his plans with attempts to see how plastics pieces might be made to fit metal pieces; he simply designed for high speed molding of integrated plastics components.

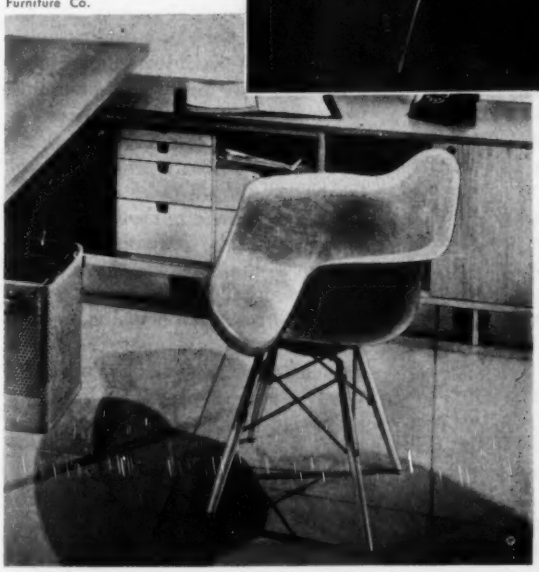
The Verifax comprises six major plastics components: a trimmer unit, a cover molding, a printing unit, a paper cabinet, a tray cover

(*Continued on p.* 199)

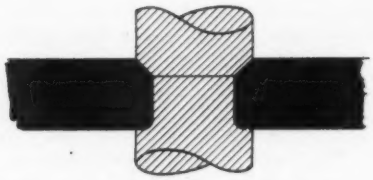
First major refrigeration appliance specifically designed for plastics, Wonderbar combines five plastics

Courtesy Servel, Inc.

Courtesy Herman Miller Furniture Co.

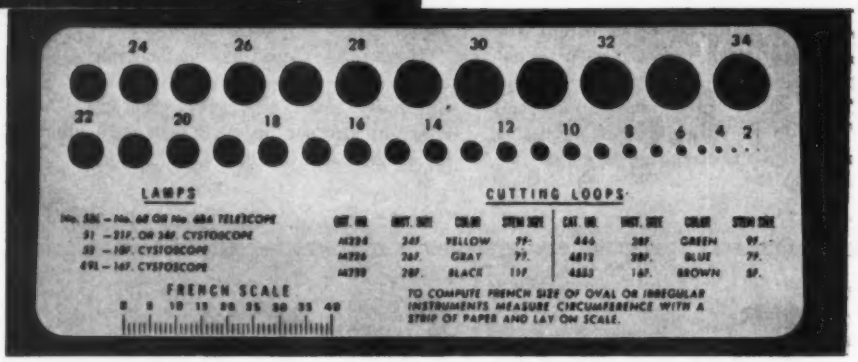


Reinforced plastics Eames office swivel chair is one of latest additions to field of furniture engineered for plastics



Molded-in holes are formed by pins that meet at bottom of 45° rims

Molded styrene alloy catheter gage has legend details roll leaf stamped to depth of 0.005 in.; gate is located inside hole 29 which is reamed out after molding operation



Precision Molding
Precision Stamping

CATHETER GAGE

Engineering and art both contributed to design and production of highly accurate molded piece

THE high precision molding and functional decoration of small specialties, particularly those in the shape of flat and tapered pieces, is a combination of engineering and art which can contribute to the future design of many plastics products.

A recent example of the excellent work being accomplished in this field is the molded catheter gage developed by American Cystoscope Makers, Inc., Bronx, N. Y. The gage represents the result of close cooperative effort between Steven Young, project engineer for American Cystoscope, and the molder and decorator to produce a product that would be attractive, handy in shape and size, and—above all—scientifically accurate.

The finished gage, which is wedge-shaped, is 6 in. by 2½ in. in area, and about $\frac{3}{16}$ in. thick at its wide edge. It contains 34 holes, ranging in size from 0.014 in. to 0.447 in., with a gently sloping curved rim around the circumference on top of each hole and a 45° rim angle at the bottom. All holes are molded in, with the two pins that form the holes meeting at the bottom of the 45° angle (see diagram). Tolerances on the molded holes are kept within ±0.0015 inch.

Molding is done in a single-cavity mold on a 6-oz. injection machine, duration of the cycle being one minute over-all.

The gate is inside hole number 29, which is located at the top center of the wedge-shaped piece and is later delicately reamed out with a special tool. Because the gate comes through the pin in the hole, there is no flash on the finished molding.

Since impact strength is needed for the unit, and some heat resistance, a styrene alloy material in ivory color is used. To preserve attractive appearance, the eight knock-out pins used in the molding operation were so tooled that their marks on the molding are almost invisible. Stamping of scale and chart detail is accomplished by roll leaf ribbon embedded to 0.005 in. to prevent any chance of wiping off as a result of frequent use.

Scales are exact to a cumulative point of ±0.005 inch. The type and rule scales are in dark green. In addition, there is a five-color code embracing maroon, silver, green, orange, and blue stamping. This is done in two operations using two multi-color tapes. One makes the odd number impressions in maroon, green, and blue, while the other fills in the even spaces in silver and orange.

Thanks to the use of plastics materials and to clever design and molding, the finished gage is a precise scientific instrument—neat, compact, clean and cleanable, and easy to use.

CREDITS: Mold design and molding for American Cystoscope gage by Monoplastics, Inc., Georgetown, Conn.; material, Monsanto's Lustrex LHA 1202 in ivory; injection machine, Lester-Phoenix, Inc., Cleveland, Ohio; roll leaf stamping tapes and machines by Peerless Roll Leaf Co., Inc., Union City, N. J.; mold by Advance Tool Co., Bridgeport, Conn.

ADHESIVES ADVANCE

FIFTEEN years ago, the possibilities of joining aluminum or steel members with adhesives that would permit shear strengths up to 3000 p.s.i. was virtually in the dream stage. Today, there are several synthetic resin adhesives being marketed that can readily attain this figure, and current developments—some still in the experimental stage—have made it possible to bond certain metals together to produce joints with a shear strength of as much as 5000 p.s.i.

Recent developments in metal-to-metal bonding have created a new potential for the metal working industries in the economical production and assembly of metal units. In contrast to wood adhesives (see first article in this series, "Wood-to-Wood Bonding," MODERN PLASTICS, *31*, 103, Nov. 1953), which, as glues of animal or plant origin, have been in existence since about 1500 B.C., metal adhesives are infants—direct offsprings of the new synthetic resin adhesives.

Prior to the introduction of metal adhesives, engineers had for years devoted much of their time to the improvement of traditional methods of joining metals—welding or mechanical fastening. Finally, having compared the tedious and clumsy process of these operations with the relative simplicity of gluing wood, they turned with notable success to adhesives. The requirements for metal-to-metal adhesives are formidable—strength, reliability, resistance to common solvents and extremes of temperature, and practicality in application—but formulations were created with synthetic resin bases that filled them all.

In the years that have passed since the introduction of metal adhesives, many new techniques have evolved in the bonding of metal to metal. These will be discussed in the following article—the second in a series dealing with recent advances in synthetic resin adhesives.

Metal-to-Metal Bonding

by George Epstein*

No. 2 of A Series

DURING the past ten years, rapid advances have been made in the development and application of synthetic resin adhesives for bonding metallic surfaces. This development has taken place primarily in the aircraft industry, where large sections of aircraft are being fabricated with the use of rigid adhesives. In honeycombs, as stiffeners for door and wing panels, and in many similar applications, these adhesives have moved into prominent position in the construction of modern aircraft, rockets, and guided missiles.

It is anticipated by many, however, that metal-to-metal adhesives will expand into other markets in the very near future. As metal working industries learn the techniques that have been developed and as they gain confidence in the new process, it can be expected that riveting and other common methods of joining will be largely replaced by resin adhesives in the automobile, shipbuilding, and other industries where high strength requirements exist.

From the standpoints of economy in the manufacturing process and the quality of the finished product, synthetic resin adhesives offer numerous advantages for bonding as compared to riveting, soldering, welding, etc. Some of these advantages are:

1) Uniform stress distribution over the bonded areas. This results in increased strength and elimination of inter-rivet buckling, such as is often experienced in aircraft applications.

2) Sealing action in addition to bonding.

3) Smooth surfaces. From the standpoint of aerodynamics, the smooth surface—unbroken by rivets or other fasteners—is more efficient in operation; from the standpoint of appearance, it is much better looking than the riveted object, unless

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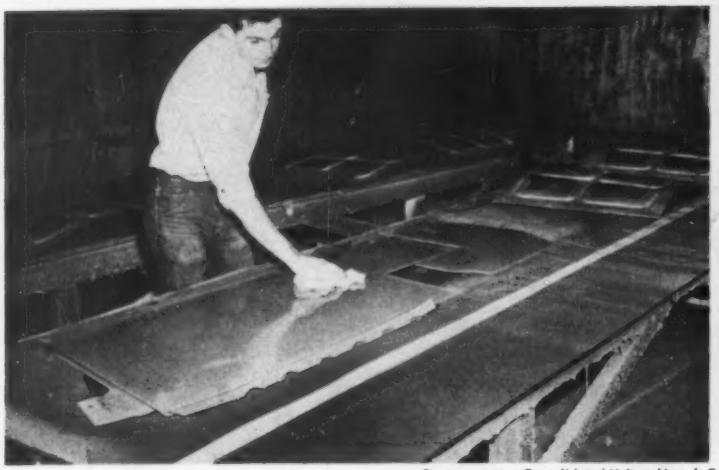
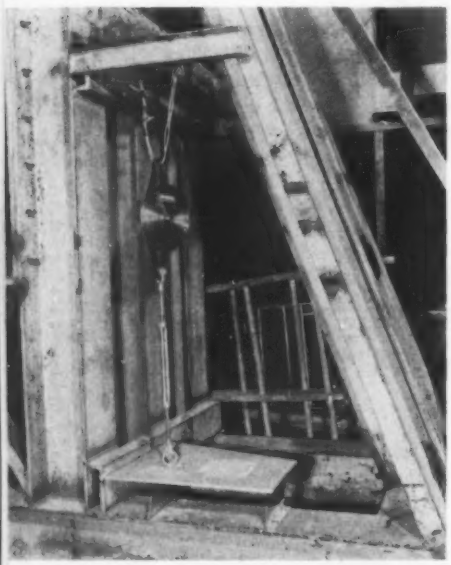


Photos courtesy Consolidated Vultee Aircraft Corp.

Synthetic resin adhesives are used to fasten metal stiffeners to the metal skin of a bomber. Initial steps in the bonding operation are the thorough cleaning of all surfaces (left) and the application of an adhesive to the cleaned skin by spray gun (right). When the adhesive has air-dried, the metal stiffeners are positioned on the skin and a second adhesive, in the form of a dried film backed by nylon cloth, is applied. The entire assembly is then removed to a special fixture for final cure



Adhesive bond between ring and floor panel is stronger than metal itself

the expensive flush-riveting technique is used.

4) Reduction in weight. A thinner gage metal than would be possible when using rivets may be employed. The relatively heavy rivets are also eliminated.

5) Reduction in cost. Actual production costs are appreciably decreased when using synthetic resin adhesives because the bonding operation is suitable for assembly line techniques, the need for piercing the metals is eliminated, and the application of the adhesive is relatively simple and rapid.

6) Insulating properties. Excellent thermal and electrical insulation may be obtained with the adhesives, if desired.

Theory of Adhesion

Two forces are considered to be of paramount importance in the bonding of any two surfaces. These are cohesion and adhesion. By definition, cohesion is that process by which the particles or molecules within the adhesive itself are bound together by forces that vary from weak to strong primary linkages. In the metal-to-metal adhesives, the cohesive forces are primarily strong covalent bonds. Such bonds are characteristic of the thermosetting adhesives in which at least one of the reactants employed is polyfunctional, that is, its molecules have the ability to react at 3 or more different positions in its structure. Consequently, a three-dimensional network results upon polymerization, since these different positions are in more than one plane.

The second force, adhesion, is the molecular attractive force which is exerted across the surface of contact between unlike materials. There are two types of adhesion—mechanical and specific. Mechanical adhesion is the phenomenon which occurs when tendrils of adhesive enter into the pores of the base material, and, as such, is especially important when porous materials, such as wood, are being bonded.

Specific adhesion, on the other hand, occurs between smooth, dense surfaces, and depends upon the chemical affinity of the adhesive and the adherent for one another. Since metals are relatively non-porous, specific adhesion is of chief importance in metal bonding. Unbalanced forces on the metallic surfaces have an affinity toward certain adhesive molecular groups, especially those which are highly polar. The thermo-

Both photos courtesy Shell Chemical Co. and Piasecki Helicopter Corp.

Floor panel (being tested, left, above) is installed in helicopter. Panel assembly consists of aluminum top sheet, aluminum honeycomb core, and aluminum bottom skin—all securely joined together with metal-to-metal adhesives based on epoxy resins. Hole inserts for fasteners are also reinforced with epoxy adhesives

setting adhesives which will be described in this article all contain such polar molecular groups.

Design Considerations

The ultimate goal in the bonding of two metallic surfaces is, of course, maximum strength. In order to attain this end, several factors must be taken into consideration in the design and preparation of the joint. These factors are:

1) Type of metal—Most metals lend themselves readily to adhesive applications. There are distinctions, however. Aluminum alloys and steel, for example, are more suitable for bonding than such materials as zinc and brass. Although most of the development work to date has involved aluminum alloys for aircraft applications, interest is increasing in the problems of bonding cold-rolled and stainless steels, magnesium alloys, and titanium.

2) Dimensions of metal and joint—Generally, the joint strength is observed to increase with the thickness of the metal, although this effect is not overly critical. In addition, the dimensions of the joint should be selected to give the largest possible bonding area. An increase in the amount of overlap area will increase the ultimate strength of the lap joint, but not proportionately; the falling load, however, is proportional to the width of the adhesive joint. Thus, the lap-width is the more critical dimension in the design of lap-type adhesive joints.

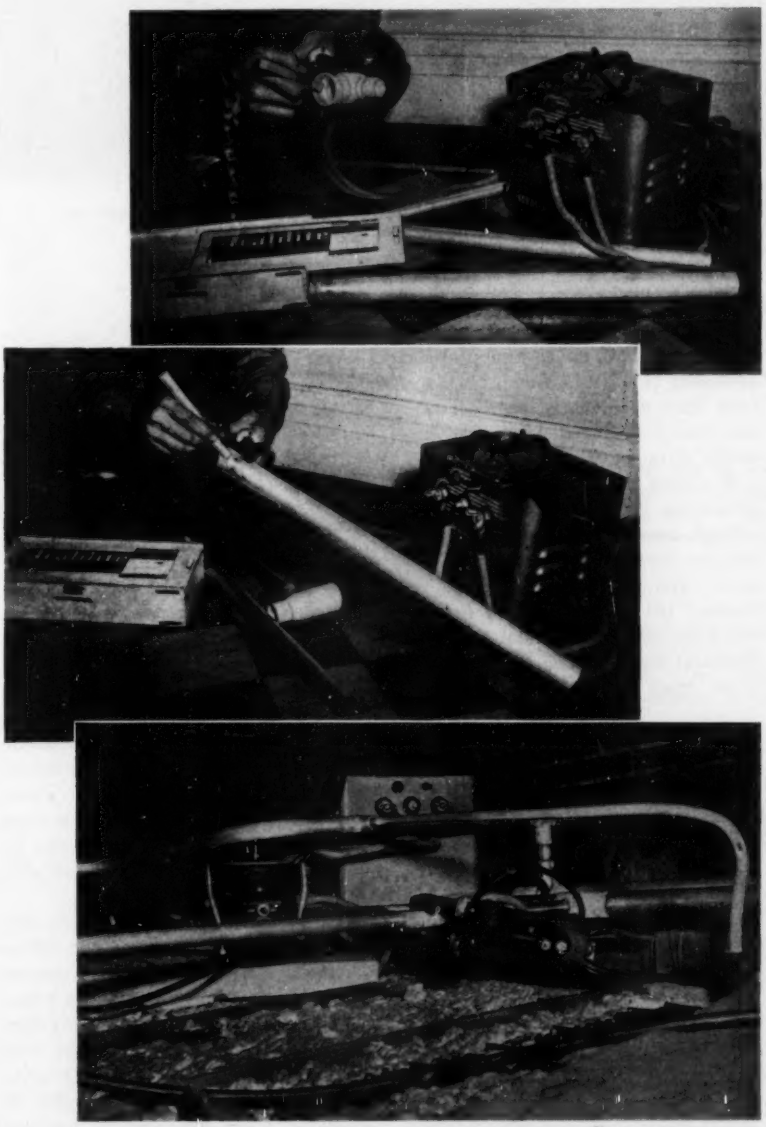
3) Type of joint—The design of the joint depends mainly upon the nature of the assembly and the application. If possible, the joint should be designed so that it will be loaded in shear rather than in tension. Any loads which tend to peel the film away from the metal should be carefully avoided. Practical advantages generally give preference to lap-joints over butt-joints. The lap-joint is easier to fabricate and less sensitive to surface irregularities and mating of parts.

4) *Surface conditions*—It is absolutely essential that the surface of the metal to be bonded is free of foreign matter. Chemical cleaning and degreasing with suitable solvents are generally desirable. Solvent wash, hot alkaline cleaning, hot acid cleaning, etc., each offer their own advantages, the choice being contingent upon the ultimate physical properties required. Sanding of the surface with a fine grade of sandpaper or light sandblasting is often employed to roughen the bonding surface while simultaneously cleaning it. The effect of a roughened surface is to increase the ratio of the actual to the apparent bonding area and also to permit a greater degree of mechanical adhesion.

The problem in selecting the correct adhesive is to choose, from competitive products, the one which provides an adequate bond under specified service conditions. There are several considerations which must be taken into account:

Are high or only moderate bond strengths required? Will the joint be subjected to both stresses and elevated temperatures during operation? Is the application of heat and pressure to the assembly permissible.

Some adhesives for metals can be cured either at room temperature or at elevated temperature. In addition to the production problems involved



Photos [illegible]

Joining pipe lines with synthetic resin adhesives is a simple, effective, and low-cost procedure. The adhesive, in solid stick form, is applied first to the aluminum fitting (top) and then to the pipe (center), both of which are heated by a resistance heater. The joint is then assembled and the adhesive is cured (bottom)

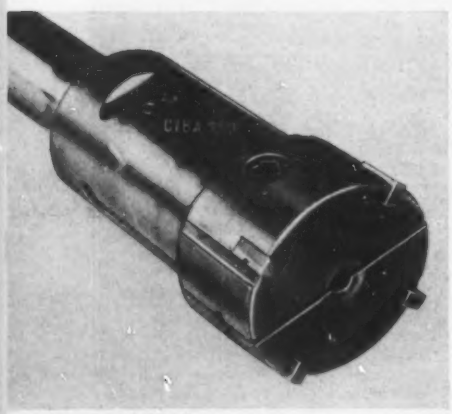
Courtesy Ciba Corp.

Weight of airplane is kept low by bonding metal stringers (running lengthwise along interior of plane) to the fuselage skin with synthetic resin adhesives

Complete listing of manufacturers of synthetic resin adhesives discussed in this series of articles can be found in the Adhesives Chart, p. 744, "Modern Plastics Encyclopedia," 1953 edition.

in using each, it must be considered that curing at room temperatures generally requires a longer period of time than at elevated temperatures and that heat-cured bonds are generally stronger than the others.

A choice must also be made between the two types of adhesives—solvent-sensitive adhesives (which require drying before assembly and cure); and 2) reaction-sensitive adhesives (in which reaction is activated by catalysts or heat or both). The first may require any length of time, from minutes to hours, for drying the film prior to bonding. The second generally requires, in the case of catalysts, careful compounding just prior to bonding. The working life of such an adhesive may be relatively short—often less than one hour.



Courtesy Ciba Corp.

Cutting lips of expansion reamer are bonded in place with epoxy adhesive

Coefficient of Expansion

Another factor which must be taken into consideration is the difference in coefficients of thermal expansion of the adhesive and metal. The more closely these approach one another, the smaller will be the stresses arising in the joint due to differential thermal expansion. The cured resins from which the adhesives are made generally have higher coefficients of expansion than the metals employed, which can be lowered by the addition of suitable fillers.

As far as the thickness of the adhesive bond is concerned, the adhesive layer should be kept as thin as possible in order to obtain the highest bond strength. However, the film must be sufficiently thick so that there are no starved areas. In general, joint thicknesses of 0.002 to 0.006 in. are employed in practice. The film or joint thickness is largely dependent upon the pressures employed during cure.

The curing conditions are generally predetermined by the nature of the adhesive and the assembly. An assembly with an irregular shape may require vacuum-bag techniques; for higher pressures, a hydraulic press may be desired. It should be noted, however, that the lowest pressure feasible could be expected to produce bonds with the lowest internal strains since, when bonding under pressure, strains are produced upon release of the pressure. The magnitude of these strains is, therefore, dependent upon the amount of pressure employed.

Typical Adhesives

Many types of adhesives can be used with metal: polyvinyl acetate, butadiene-acrylonitrile rubber, etc., and many variations can be effected within each grouping. Many thermosetting resins, for example, that are used in bonding metal to metal are being combined with synthetic rubbers to create an adhesive formulation with better elasticity. Other modifications of the basic metal-to-metal synthetic resins include the addition of various fillers such as metallic oxides, metallic powders, asbestos, and clay, and other silicates, to control physical properties of viscosity, flexibility, etc.

Some of the most important metal-to-metal adhesives are those based on phenolic resins. When fully cured, these adhesives have good mechanical strength, good heat resistance, dimensional stability over a wide range of humidity and temperature conditions, low water absorption, and resistance to solvents and chemicals. Unlike other synthetic resin adhesives, most of the phenolics do not require the addition of catalysts before use. Various degrees of flexibility can be obtained by the addition of elastomeric materials, mineral fillers, and substituted phenols.

A two-component adhesive, Re-

(*Continued on p. 202*)

A Perpetual Plastic Premium

LATEST premium deal—and certainly one of the most unusual—to successfully use plastics, involves a series of molded acetate dolls sold in conjunction with a packaged soap product. In contrast to conventional premium practices, which usually call for boxtops or coupons, each doll will be sold directly across the counter as part of a combination package which includes a box of the soap. The price for both units is a little less than half the retail value of the doll alone.

Eight dolls, each one dressed in an attractive costume to represent a famous American heroine or historical female figure, comprise the current series. The 7 in. high dolls are packaged in individual boxes designed and decorated to resemble a book.

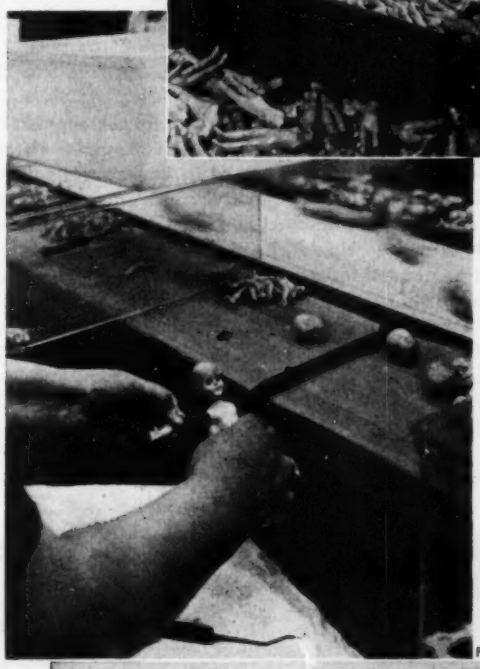
A short biographical sketch of the person represented by the doll is printed on the inside front cover of the "book," directly opposite the doll described.

In designing this special plastics premium item, the emphasis was on economy without sacrificing product quality.

The dolls are injection molded of durable, flesh-colored acetate that can withstand rugged treatment in the hands of a child. A realistic wig is cemented securely to the head of each doll and the toy is so assembled that its arms and head may be moved. The eyes of the doll also open and close.

Since the item is designed to promote the sale of the detergent, its introduction will be backed by an intensive nationwide promotion and merchandising campaign—a feature which the manufacturers feel will contribute much to the future of plastics in the creation of quality premium products.

CREDITS: "Album Americana" dolls were developed by The Colgate-Palmolive-Peet Co., in conjunction with Plastic Molded Arts, Long Island City, N. Y.; cellulose acetate supplied by Celanese Corp. of America, New York, N. Y.



Injection molded in multi-cavity die, acetate doll components are separated from sprue and sorted preparatory to assembly operation

Part of production line on which flesh-colored dolls are assembled shows jig being used to attach movable arms to doll bodies

Biographical sketch of character represented by doll is given on inside cover of carton, which, when closed, resembles a book

Photos courtesy Celanese Corp. of America

What You Should Know About

PLASTICIZERS FOR VINYLS

by E. B. Deckel*

The first two articles of this series have dealt with plasticizers used with vinyl chloride film and sheeting (MODERN PLASTICS, October 1953, p. 116) and plasticizers for vinyl extrusion compounds (MODERN PLASTICS, November 1953, p. 93).

This third and concluding article discusses the subject of plasticizers in vinyl dispersions.

VINYL dispersions, while not new to industry, are finding new uses almost daily. The selection of a plasticizer system which will provide good physical properties for a particular application and which will be easy to process is critical to new and old users alike. To develop the formulation he needs with a minimum of trial and error testing, the compounder must have a knowledge of the different plasticizers available as well as the effect they will have on vinyl dispersions.

* B. F. Goodrich Chemical Co., Cleveland, Ohio

There are two basis systems used to make vinyl dispersions—vinyl resin dispersed in non-aqueous media and vinyl resin dispersed in water. Although many of the principles of plasticizer selection are identical for both these systems, there are also many differences which characterize and distinguish the two.

Non-Aqueous Dispersion

The first group, non-aqueous dispersions, can be sub-divided into two divisions—plastisols and organosols. Plastisols, which are composed essentially of a very finely divided vinyl resin dispersed in plasticizer, are used in making a large and versatile number of end products. Some of the more common ones are plastics plants, rain bootees, vinyl sponge, upholstery material, and protective coatings for industrial gloves, awnings, plating racks, and glass fibers.

Organosols contain, in addition to plasticizer, varying amounts of organic solvents as diluents which are evaporated during the fusion cycle.

Photos courtesy Kee-Bair Products

At start of compounding a polyvinyl chloride plastisol, resin is being added to plasticizer which contains pigment, stabilizer, and filler materials

Same polyvinyl plastisol as shown at left, now with all the resin added, as it nears the end of mixing cycle

Organosols are used where the manufacturer desires a drier, thinner film, usually 2 to 4 mils thick, for such applications as protective spray coatings, fabric coatings, and various dip coatings where a minimum build-up is required for satisfactory results.

Both plastisols and organosols contain other compounding ingredients such as stabilizers, pigments, and fillers.

Water Dispersions

The second group, water dispersions or vinyl latices, comprises several varieties, the major types being vinyl chloride polymers and copolymers, and polyvinyl acetate. The vinyl chloride polymer and copolymer dispersions are generally available at a particle size of about 0.2 micron. The polyvinyl acetate emulsions, on the other hand, are furnished in a range of particle sizes up to 10 microns, and at various molecular weights.

In most cases, the use of plasticizers with the water-dispersed system is essential to the process of continuous film formation, as well as to the securing of specific properties in the film itself. Plasticizers may be added directly to the dispersion, as practiced widely with polyvinyl acetate, or in the form of emulsions, as recommended for the compounding of vinyl chloride latices. Fugitive plasticizers such as methyl isobutyl ketone, cyclohexanone, and ethylene glycol are sometimes used to meet special requirements. However, this discussion will be limited to the more permanent types, such as the high boiling monomeric and polymeric esters.

Latices may be used as clear or pigmented coatings on paper, fabrics, wire, and structural materials, as waterborne printing inks, or as binders or saturants for fibers, fabrics, and pigments. They are found in better grade wallpaper and food containers, durable and attractive upholstery, and in a variety of fabric prints.

Types of Plasticizers

Most plasticizers which have found acceptance in the fields of extrusion, calendering, and injection molding of vinyls are also used in the dispersion systems. Because of similarities in the properties they provide, they are classified by chemical type in the following discussion.

The *phthalates* are used more widely than any other class of plasticizer in compounding. Figures showing consumption of plasticizers by the vinyl industry in 1951[1] indicate approximately 60% of the total plasticizers used belong to the phthalate family, the bulk being dioctyl phthalate and its isomers, which impart such good general properties to a vinyl molding compound. Other phthalates which are used to a lesser degree are butyl benzyl, butyl cyclohexyl, dicapryl, and octyl decyl phthalate. The phthalates are completely compatible with vinyl chloride resins and phthalate plasticized compositions have good low temperature properties and also show good resistance to water extraction.

For exceptionally good low temperature flexibility, the *adipates*, *sebacates*, and *azelates* are used. They are considered as primaries, since they do not bleed or exude from a compound. The plastics compounds in which they are used have low volatility and fair resistance to various immersants.

Ricinoleates have limited compatibility in vinyls and because of this are considered secondary plasticizers. Their strong point is that they improve low temperature flexibility of vinyls. Methyl acetyl ricinoleate, butyl acetyl ricinoleate, and methyl cellosolve acetyl ricinoleate are the three types commercially available at the present time.

The *phosphates*, such as tricresyl phosphate, are primaries and are excellent for chemical resistance, low volatility, and flame resistance. The low temperature flexibility of vinyl compounds containing tricresyl phosphate, triphenyl phosphate, and trixylenyl phosphate is poor,

[1] H. Avery, "Plasticizers Set New Records," Modern Plastics, *30*, 84, (Sept., 1952).

Table I—Primary Plasticizers: Formulation: Geon Resin 121—100, Plasticizer—66

	Flow Properties (77°F.)					
	Aged one day			*Aged one week*		
Plasticizer	*Low shear visc. (cp.)*	*Yield value (d./cm.²)*	*High shear visc. (cp.)*	*Low shear visc. (cp.)*	*Yield value (d./cm.²)*	*High shear visc. (cp.)*
Dioctyl phthalate	5200	200	8100	6900	400	12,000
Dicapryl phthalate	3800	None	7500	4500	200	9,200
Butyl benzyl phthalate	5700	None	34,000	10,000	None	57,000
Dioctyl azelate	700	150	1000	1200	100	1500
Dioctyl adipate	900	200	1100	1500	200	1700
Dioctyl sebacate	800	100	1000	1000	150	1400
Tricresyl phosphate	5200	None	210,000	17,000	None	290,000
Trioctyl phosphate	1000	50	1200	1300	150	1700
Alkyl-aryl phosphate	900	50	1000	1200	400	1500

Table II—Secondary Plasticizers: Formulation: Geon Resin 121—100, Dioctyl Phthalate—44, Secondary Plasticizers—22

	Flow Properties (77°F.)					
	Aged one day			*Aged one week*		
Secondary Plasticizer	*Low shear visc. (cp.)*	*Yield value (d./cm.²)*	*High shear visc. (cp.)*	*Low shear visc. (cp.)*	*Yield value (d./cm.²)*	*High shear visc. (cp.)*
Methyl acetyl ricinoleate	3600	200	6000	4800	200	7500
Chlorinated (40%) paraffin	36,000	None	55,000	21,000	None	46,000
Tetrahydrofurfuryl oleate	2700	100	4000	3400	200	4800
Tetraethylene glycol di-isohexoate	2800	None	5200	1700	None	5300
Medium viscosity polymeric	19,000	None	37,000	23,000	None	40,000
Low viscosity polymeric	9400	None	19,000	9500	None	20,000
Hydrogenated terphenyl	3400	None	11,000	6200	None	12,000
Petroleum aromatic hydrocarbon	5300	200	11,000	9200	None	14,500

Courtesy Wallace Container Co.

Collapsible vinyl tube is made of plastisol resin (non-aqueous dispersion)

but this can be improved at the expense of some of the non-flammability characteristics by substituting octyl diphenyl phosphate or trioctyl phosphate.

When it is necessary to have almost negligible volatility, excellent water and oil resistance, and a minimum tendency to migrate, the *polymeric plasticizers* are used. Chemically, there are two groups: 1) those based on synthetic rubber, such as the butadiene-acrylonitrile types; and 2) linear polyesters, some of which are produced from dibasic acids and polyglycols.

The synthetic rubber types of plasticizers are solids and currently are used only in water dispersions in which they are often the sole plasticizer. Polyesters, which generally are secondaries, lend themselves very well to the plasticization of vinyl chloride dispersion systems.

Glycol derivatives are noted for their ability to provide low temperature flexibility. They are secondaries and generally exhibit only fair water and oil resistance. Representative of this group is tetraethylene glycol di-isohexoate.

Where price is important, *low cost petroleum extenders* are useful as secondary plasticizers. Compounds containing them are usually dark in color, have a petroleum-like odor, relatively high volatility, and poor chemical resistance. Other low cost secondaries are the *chlorinated paraffins* and methyl pentachlorostearate, which are useful in making vinyls flame resistant, and hydrogenated terphenyl. In actual practice, blends of plasticizers are used in order to meet price and performance specifications.

Plasticizers in Plastisols

When a compounder is working with a plastisol system, not only must he know what part each individual plasticizer plays in the properties of the finished product, but he also must know what effect the plasticizer has on the paste viscosity.

The question of plastisol viscosity is a critical consideration because each processing method—coating, slush molding, or dipping—demands a given level of viscosity for satisfactory operation. A detailed article on the relationship between plastisol viscosity and end use has been published[2].

Tables I and II, are based on data published in reference 2. The tables show how different types of plasticizers affect plastisol viscosity.

On the basis of studies such as these, plasticizers can be divided into three groups based on the low shear viscosities of the Interchemical Rotational Viscometer: 1) low

[2] Todd, W. D., "Some Rheological Aspects of Vinyl Plastisols," Official Digest, Feb., 1952.

viscosity (up to 4000 cp.), 2) medium viscosity (4000-10,000 cp.), and 3) high viscosity (above 10,000 cp).

This division is based on a simple plastisol containing 100 parts of Geon 121[3] resin and 65 parts of plasticizer. Secondaries are evaluated at 25% replacement of dioctyl phthalate. It is interesting to note that, if a plasticizer itself has a low viscosity, the plastisol has a low initial viscosity. This does not always hold true, however, on aging of the material.

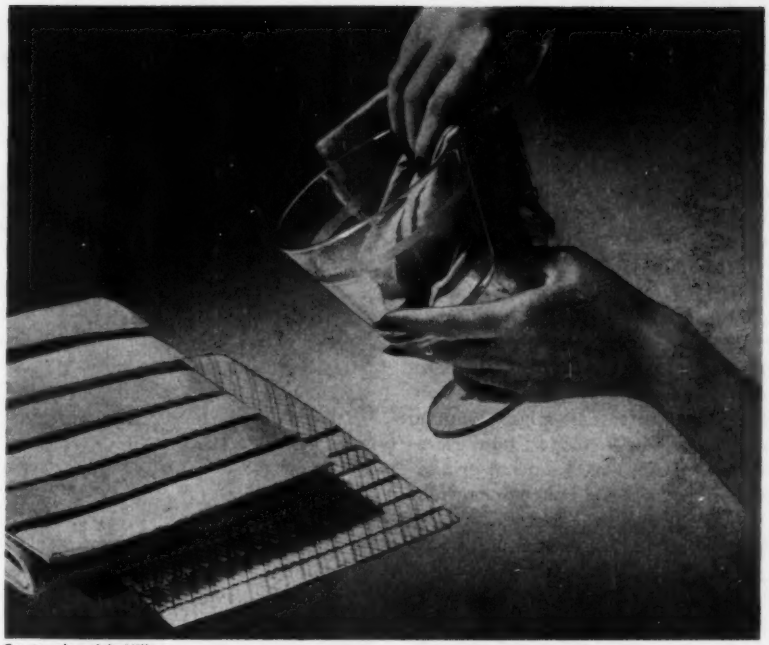
Compounding Plastisols

In the low viscosity division are such primaries as dioctyl adipate, dioctyl sebacate, trioctyl phosphate, dicapryl phthalate, dioctyl azelate, and octyl diphenyl phosphate. Methyl acetyl ricinoleate, tetrahydrofurfuryl oleate and other fatty acid derivatives, and tetraethylene glycol di-isohexoate are examples of secondaries in the low viscosity group. For medium viscosity, the lower viscosity polymerics, tributoxy ethyl phosphate, hydrogenated terphenyl, and petroleum type extenders are used.

Tricresyl phosphate is a primary plasticizer which gives a high viscosity plastisol. Other high viscosity plasticizers are mainly secondaries such as the high viscosity polymerics and the chlorinated compounds.

In most plastisol compounding, dioctyl phthalate is present as the basic plasticizer, and blends of the other types are added for viscosity, low migration, low temperature flexibility, and flameproof characteristics. One manufacturer for example, wanted a compound that could be slush molded to give a product with a soft, life-like feel and with a minimum tendency to migrate when in contact with a nitrocellulose lacquer. The plastisol also had to have a viscosity below 10,000 centipoise. Thus, while the requirements of viscosity and life-like feel called for a high plasticizer level, the higher the plasticizer content became, the more pronounced was the migration tendency. As a solution to the problem, it was found that a polymeric-monomeric combination met the product specifications. With the necessary pigment and stabilizers, the final formulation contained:

[3] B. F. Goodrich Chemical Co., Cleveland, Ohio



Courtesy Avondale Mills

Wiping cloth of non-woven fiber impregnated with a polyvinyl chloride-copolymer latex is only one example of varied applications for water-dispersed vinyl resins

Geon resin 121	100 parts
D.O.P.	50 parts
Polymeric plasticizer (medium viscosity polyester)	50 parts
Barium-cadmium stabilizer	2 parts
Organic phosphite stabilizer	2 parts
Pigment and filler	10 parts

In another instance, a minimum of plasticizer was wanted in order to get a hard, dry film suitable as a top coat for fabric. No diluent could be tolerated because of available processing equipment. Good low temperature flexibility was desired.

The final formulation had two secondary plasticizers for low temperature and low viscosity properties with dioctyl phthalate as the base plasticizer. Total plasticizer content was 44 parts as shown below:

Geon resin 121	100 parts
Dioctyl sebacate	11 parts
Tetraethylene glycol diisohexoate	11 parts
Dioctyl phthalate	22 parts
Barium-cadmium stabilizer	2 parts
Organic phosphite Stabilizer	2 parts

Organosols are dispersions of a vinyl resin in plasticizer systems containing varying amounts of one or more volatile organic diluents. The stir-in type is essentially a plastisol which has been diluted with a relatively small amount of volatile organic thinner, usually aliphatic or napthenic. In this way, the plasticizer content can be decreased in order to increase film hardness and tensile strength and decrease surface tack.

Where the formulation is dispersed in a ball mill or on a three-roll ink mill, the selection of the thinner system is of paramount importance because it serves as the suspending or dispersing medium. The plasticizer system, because of its relatively low level, plays a minor role in its effect on viscosity values. The same considerations govern the choice of plasticizers used in ground organosols as in plastisols so far as functional properties are concerned.

Plasticizers in Water Dispersions

Except for a few cases involving polyvinyl acetate, the plasticizers used in organosols and plastisols can be employed effectively in water dispersed systems. Polyvinyl acetate may be plasticized by the direct addition of the plasticizer to the latex

with moderate stirring. Several general principles on the plasticization of the polyvinyl acetate are given below[4]. It is interesting to note that dioctyl phthalate, the most widely used plasticizer in the other dispersion systems tends to become incompatible with this type of emulsion.

1) Polyvinyl acetate is compatible with most of the ester-type nitrocellulose lacquer plasticizers.

2) The lower phthalate and phosphate esters are effective plasticizers. Optium film properties, particularly flexibility, non-migration, and adhesion, are developed with dibutyl and diamyl phthalate or triphenyl and tricresyl phosphate. The higher phthalates, such as dioctyl phthalate, tend to become incompatible with polyvinyl acetate.

3) Many plasticizers, ordinarily considered as too low boiling for effective use with polyvinyl chloride, work well with polyvinyl acetate because the resin acts to lower the vapor pressure of the plasticizer to an extent where plasticizer loss by evaporation or diffusion is negligible. Dimethyl phthalate, for example, is an effective and, for many purposes, an essentially non-volatile plasticizer for use with polyvinyl acetate.

4) Esters of the higher fatty acids are not effective plasticizers for polyvinyl acetate. For example, oleate, stearate, and ricinoleate esters are incompatible with polyvinyl acetate.

5) Certain materials, not ordinarily considered as plasticizers for polyvinyl acetate, can be used as effective extenders for more active plasticizers. An example of such an extender material is orthonitrodiphenyl.

[4] Technical Bulletin P-16 Polyvinyl Acetate Emulsions, American Polymer Corp., Peabody, Mass.

End Products

Plasticizers for vinyl chloride polymer and copolymer latices are chosen on much the same basis as that which governs their use in the non-aqueous systems. The requirements for latex end products are more limited than those for vinyl dispersions in organic systems, and this is reflected in the fact that dioctyl phthalate, nitrile rubber, and certain phosphate plasticizers account for almost all the plasticizer consumption in vinyl latex compounding.

Plastics plant is molded of a plastisol. Non-aqueous solutions of vinyl resins are also used for heavy protective coatings, vinyl sponge, upholstery materials, and other items

Courtesy Plastic Plants Co.

Of the three types mentioned, dioctyl phthalate is the most widely used because it provides good all-around properties just as it does for the other dispersion systems. Latices containing nitrile rubber plasticizers, which are based on a copolymer of butadiene-acrylonitrile, are used where a non-toxic, non-migratory, and non-extractible coating is wanted. Phosphate-plasticized latices are used especially for flame resistance and non-toxicity.

Typical examples in which the above mentioned plasticizers are used with polyvinyl chloride and copolymer latices are rug backings coated with latex for its binding and stiffening action; dusting cloths made from latex-impregnated nonwoven fabric; latex-impregnated flameproof clothing; and greaseproof cartons.

Plasticizer Concentration

When adding an ester type plasticizer to a polyvinyl chloride latex, it is first necessary to make an oil-in-water emulsion by adding the plasticizer to water containing an emulsifier such as ammonium or morpholine oleate. This crude emulsion then is passed through a colloid mill, homogenizer, or high shear mixer in order to reduce the plasticizer to very fine droplets which will stay suspended in the aqueous medium.

The concentration of plasticizer is important in such a system for two reasons. First, too viscous an emulsion causes air entrapment and, secondly, too dilute a concentration of plasticizer generally results in creaming effects.

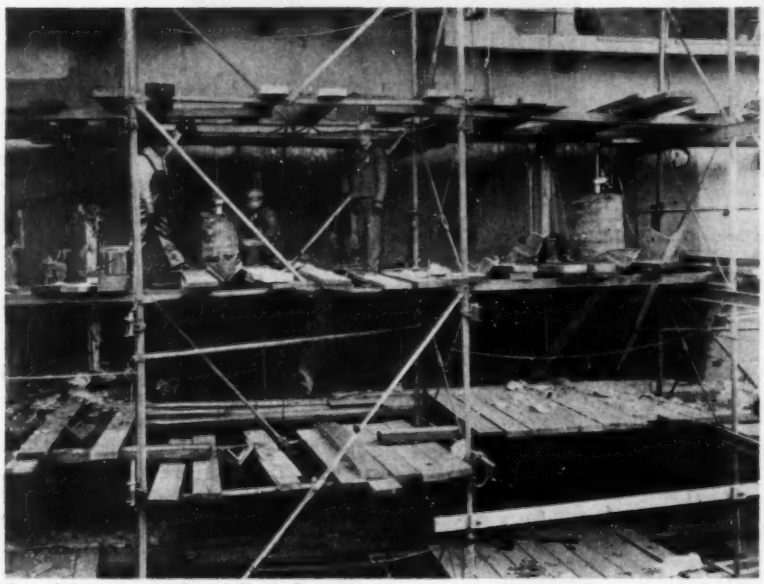
These problems of plasticizer addition can be avoided by the use of preplasticized latices which already contain monomeric ester plasticizer such as a phthalate or a phosphate plasticizer.

Nitrile rubbers are available as water emulsions and can be added to a vinyl latex with gentle stirring. This mechanical blending also can be avoided by using a preplasticized vinyl-nitrile rubber latex.

The advantages of preplasticized latices are that they eliminate a mixing procedure for the user and they provide films and coating with superior physical properties due to intimate dispersion of the plasticizer and vinyl latex.

Phenolic Foam in Aircraft Carriers

by J. D. Nelson*



Photos this page courtesy General Electric Co.

Electric mixers (center plank) beat air into liquid phenolic; adjacent chutes send catalyzed mixture to ship's blisters where it solidifies at 300 times original volume

THE ability to convert from a liquid resin to an expanded solid in a matter of two or three minutes without external heat or pressure is one of the outstanding characteristics of phenolic foam. Because of this characteristic, and because the expanding resin will assume the shape of the cavity in which it is formed and will completely fill it, phenolic foam makes successful use of the foamed-in-place technique.

Foams are made from liquid phenolic resins by a chemical blowing process that expands the resin up to 300 times its original volume. When a catalyst, usually acidic in nature, is added to the resin, a heat-liberating reaction is initiated as the catalyst reacts with bicarbonate of soda in the mixture to produce carbon dioxide gas. The heat that is thus generated turns the water in the mixture into steam, which also contributes to the expansion of the resin.

Sometimes, additional ingredients are added to assist in controlling the density and to help the cell formation of the foam. For certain other applications, air is beaten into the resin before the catalyst is added. The air functions as seeding nuclei for the expansion process, as well as an additional source of blowing agent. Although it proportionately reduces the compressive strength of the material, air will generally produce foam with a more resilient texture.

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Navy Applications

For some years previous to the introduction of phenolic foam for military craft, the Navy was using balsa to fill blister voids along the water line of small aircraft carriers. Balsa imparted buoyancy to the ship and prevented excessive listing of the ship in the event the hull was pierced by shells.

Because these voids varied in size and shape, the balsa had to be hand-tailored in place, and before a cover plate was welded over the void, the tailored balsa had to be removed, fireproofed with a special impregnant, and replaced again—a very costly process.

Then the Navy switched to the highly buoyant, easy-to-use phenolic foam. The results? Actual fabrication time was reduced, the fireproofing step was eliminated, and the over-all cost per cu. ft. of void space shrank 75 percent.

In one carrier installation involving 40,000 lb. of phenolic resin and a void volume of 8100 cu. ft., for example, the foamed-in-place technique was used under the most adverse weather conditions. Yet, the job was completed with a minimum of difficulty in approximately 70 dry-dock days. Total cost—$6.88 per cu. ft. of space.

In contrast, a similar installation which used balsa to fill only 4900 cu. ft. of blister voids took 167 dry-dock days to complete and cost $27.62 per cu. foot.

But even with their unusual "self-fabricating" characteristics, the phenolic foams are not limited to aircraft carrier applications. They are also used as low-temperature and acoustical insulations, structural reinforcement for tail sections of airplanes, buoyancy media for boats of all types, and as packaging materials. Research is also being conducted on new uses in the insulation field—either for home or industry—that have been opened by the introduction of phenolic foam. Tomorrow's homes, for example, may be insulated with phenolic foam just as simply as an oil dealer now fills the home fuel-storage tank.

Cover plates removed (left) to show how phenolic foam fills voids

Photos courtesy Zenith Radio Corp.

Midget radio is housed in phenolic cabinet which encloses it on all sides. Molded styrene handle, which recesses into slot in top of cabinet, conceals iron core loop-type antenna

Small but MIGHTY

Zenith radio has unusual phenolic cabinet with molded-in grille; antenna is housed in molded styrene handle

EXEMPLIFYING the "miniaturization" trend in home radios, made possible through such developments as midget tubes, selenium rectifiers, etc., is the Crest a.c.-d.c. model recently introduced by Zenith Radio Corp., Chicago, Ill. Housed in a molded phenolic cabinet of somewhat unusual design, measuring only 4 9/16 in. high, 6 7/8 in. wide, and 4 3/8 in. deep, this model proves once more that with properly selected plastics, a radio may be made extremely compact without sacrificing performance.

Antenna in Handle

The Crest has a powerful iron core type "hand-tenna," built directly into the folding handle, which gives the set unusual range, volume, and selectivity. The molded styrene handle, designed to comfortably fit the hand when swung up, recesses into the top of the cabinet when lowered. In the raised position, the handle greatly increases the performance of the set by keeping the antenna farther away from the metal chassis of the set.

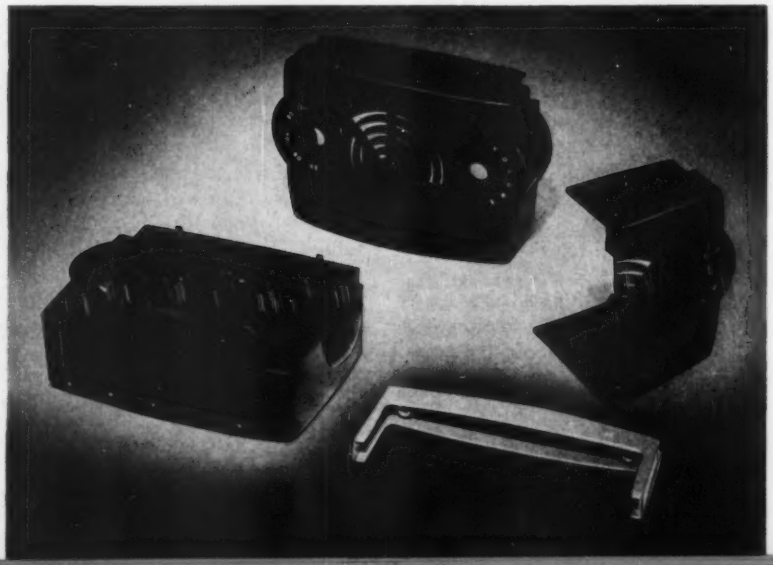
The cabinet of the Crest radio includes a circular speaker grille with six concentric ribs centered on the front, flanked by the tuning calibrations and the volume control. These legends are molded-in and wiped-in for increased legibility. The housing consists of two vertical halves—a front and a back—which form a completely enclosed unit when assembled. This construction provides an extremely rigid cabinet which shields the working parts against penetration of dust or other foreign matter. It also results in a cabinet which presents a finished appearance from all sides and need not be placed with the back against a wall. The front section of the case, larger of the two components, forms most of the base of the cabinet and is designed with two external ribs on which the set rests.

All of the cabinets are molded in ebony general-purpose phenolic material. Some of them are sold in this color, with gold color trim. Other sets are finished in ivory, dawn grey, or maroon, using a sprayed-on baking type finish. Trim used on the grey and maroon sets is silver, while a gold trim is applied to the ivory cabinets. In each instance, the control knob centers feature a harmonizing trim color.

The matching case halves for the

(*Continued on p. 208*)

Cabinet consists of two matching molded parts. Styrene handle (foreground) is open underneath to accommodate antenna. Depth of grill-forming ribs is shown at right



"EXTRUDED" REINFORCED PLASTICS

Continuous production of almost any extrudable shape opens new possibilities for glass reinforced resin

THE recent introduction of a specialized production unit to serve the reinforced plastics industry has created a new host of end product possibilities for the material. Complementing as it does the present production facilities of the industry, the new machine successfully fills a long-standing need by providing for the economical production of reinforced plastics bar, rod, and tube stock in continuous rather than finite lengths.

Called the Glastruder, the unit was invented by W. Brandt Goldsworthy and Fred Landgraf and developed and built by Hugh C. Marshall Co., Santa Ana, Calif. The shapes that are run off on it—Glastrusions—are fibrous glass-reinforced plastics structural members producible in most any extrudable form.

Operation

The machine is capable of a high volume of production and operates almost completely automatically. Two semi-skilled workers can, in fact, supervise several of the machines simultaneously.

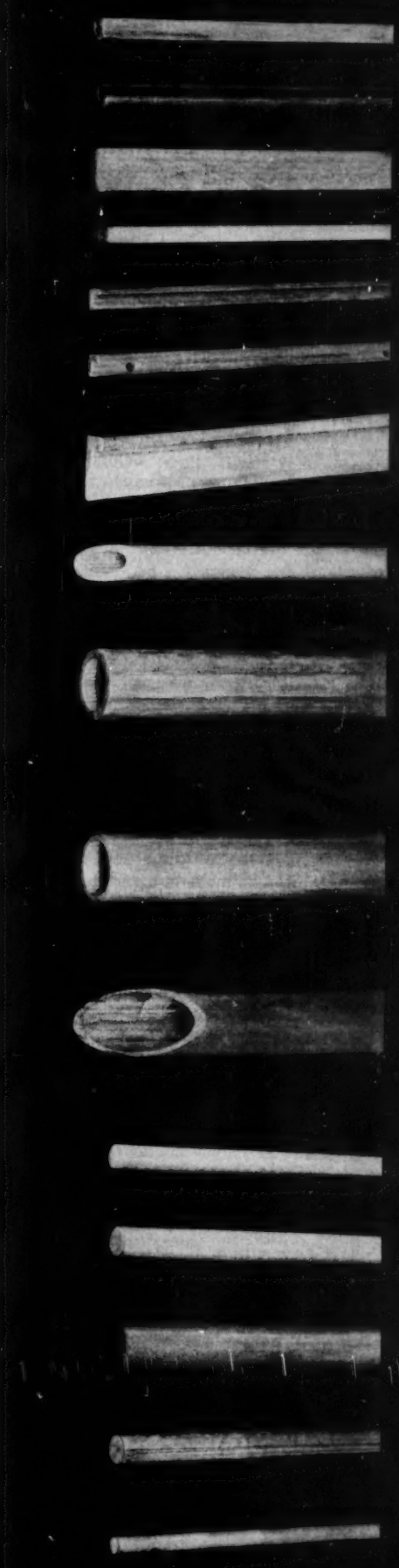
Each Glastruder is equipped at one end with a specially designed rack on which the fibrous glass rovings are stored in cake, spool, or tape form.

When the Glastruder machine is in use, these fibers are pulled, under carefully controlled tension, through a series of tubes which lead to a carding device. The carding device distributes the fibers properly as they pass through it and into a resin-impregnating tank which rests on the bed of the machine. After passing through the tank, the impregnated fibers are drawn horizontally through a series of special dies and into a curing die, where a high frequency current is applied. During the curing stage, the fibers remain under constant tension from a pulling machine operated by a ¾-hp. electric motor.

Finally, the finished stock is rolled out on a conveyor and either coiled or cut off at the desired length by an abrasive saw. The entire machine can be installed in an area measuring approximately 20 by 70 feet. Power requirements for the complete set-up are approximately 5 kw. In some installations, compressed air is required.

Continuous Process

The run of reinforced plastics structural shapes from the machine is completely continuous. Additional resin is simply added directly to the tank while the machine is in operation and additional fibers are spliced



Courtesy Hugh C. Marshall Co.
Reinforced plastics stock produced by new unit is offered in a wide range of shapes

while they are being run, without interrupting the operation.

The benefit of this type of run lies in the economy of production resulting from labor savings and material waste savings. However, there are applications where the reinforced plastic stock, by the very nature of being continuous, can save many production and installation dollars. The most promising of these is in the production of long lengths of pipe without joints. Already, the manufacturer of the machine has come up with a novel idea in pipe production which he claims is entirely feasible. This idea is to mount the entire unit on a trailer or truck to follow closely behind a trenching machine and produce and immediately lay down completely finished pipe at a constant rate of speed, thus increasing the efficiency of pipe-laying operations manyfold.

Photos both pages courtesy Hugh C. Marshall Co.

When machine is in operation, the fibrous glass rovings stored at one end of the unit pass through a series of tubes above the spools and into a carding device

Physical Properties

Because of the lamination of the parallel fibers of glass under tension, the structural shapes that are run off the machine have unusually high strength. In addition, these formed parts possess good chemical resistance and excellent electrical properties.

The table below gives the physical properties of a typical Glastrusion. Since these structural shapes can be made in a variety of sizes—to date, sections up to 3 in. in dia. have been produced—and since a wide range of fibers, resin types, catalysts, fillers, etc., can be used, the specific properties of a Glastrusion can be varied to fit a wide range of specific uses.

The specifications that have been listed in the properties table, therefore, are of a general nature and cannot be used as a criterion. The specimen that was used in determining the specifications contained 65% Fiberglas, supplied by Owens-Corning Fiberglas Corp., and 35% polyester resin, supplied by General Electric Co.

As a result of these outstanding physical properties, the reinforced plastics stock has proved adaptable to a variety of industries ranging from sporting goods to the building and construction trades. Included among these applications are the following uses:

Sporting goods—Solid reinforced plastics rods, centerless ground to a taper, make excellent fishing rods; archery bows fabricated from rod stock afford durability and power; and arrows made from light weight tubing remain balanced even after repeated use.

For ski poles, solid rods are centerless ground to give the correct flexure. Similar shapes—in thicker and heavier sizes—are suitable for use as corrosive-resistant, weather-resistant boat fittings or in the construction of light weight, durable camping equipment.

Heavy Industry

Automotive—Reinforced plastics rods, tubing, and channels when used for the bracing, trim, frames, and moldings on new sports cars and station wagon bodies, will help contribute to the production of such cars at lower costs.

Petroleum—In addition to the use of Glastrusions for oil field pipes, tests are now being conducted on possibilities opened by using the material as "sucker rods" to pump oil from wells in corrosive areas—an application that could open up new oil fields that heretofore had not been economically productive and therefore had remained completely unexploited.

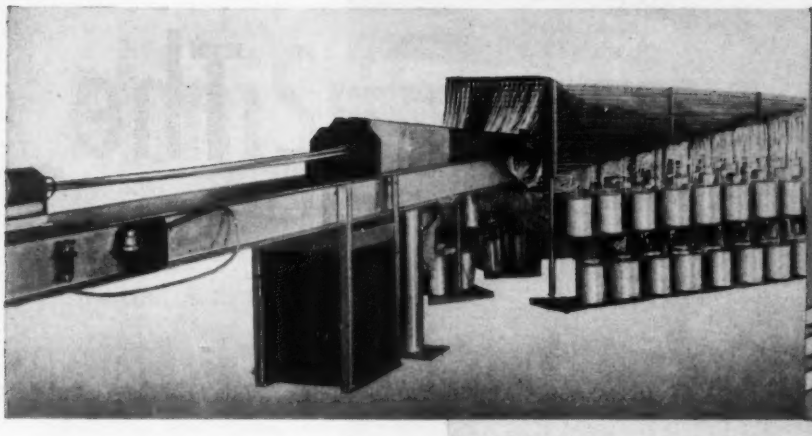
Electrical Applications—The excellent insulating qualities and good dielectric strength of the reinforced plastics structural shapes are used to advantage in terminal blocks, tuning wands, slot wedges, and controls. Since the material can be produced with metal rod or wire either as core or as an outside winding, it is also suitable for use in antennas or as a strong waterproof sheathing for wire in electrical, structural, electronic, and other applications.

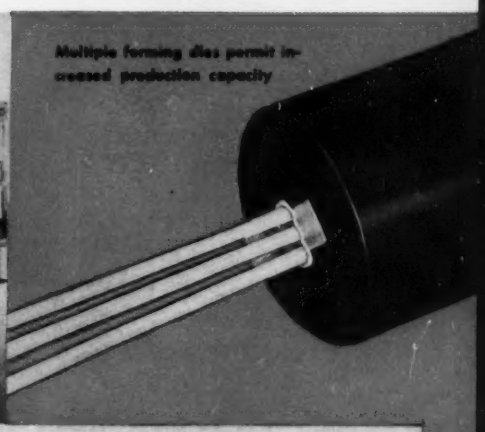
Furniture—Very attractive, dur-

Physical Properties of Glastrusions*

Tensile Strength	10,000 to 144,700 p.s.i.
Modulus of Elasticity	5.3×10^6
Compressive Strength	40,000 p.s.i.
Flexural Strength	64,000 p.s.i.
Rockwell M Hardness	112
Barcol Hardness	65
Specific Gravity	1.85
Water Absorption (weight change after 24 hr.)	+0.108%
IZOD Impact Strength	17.1 ft. lb./in. notch

*Because of the wide range of fibers, resin types, glass content, catalysts, fillers, pigments, and dyes used to make various Glastrusions for specific uses, these specifications are of a general nature and are not to be used as criteria.





Multiple forming dies permit increased production capacity

Carded fibers are then pulled through a resin bath and into a forming die (right)

able chairs, tables, lamps, and decorative trim can be made from reinforced plastics structural shapes at competitive prices.

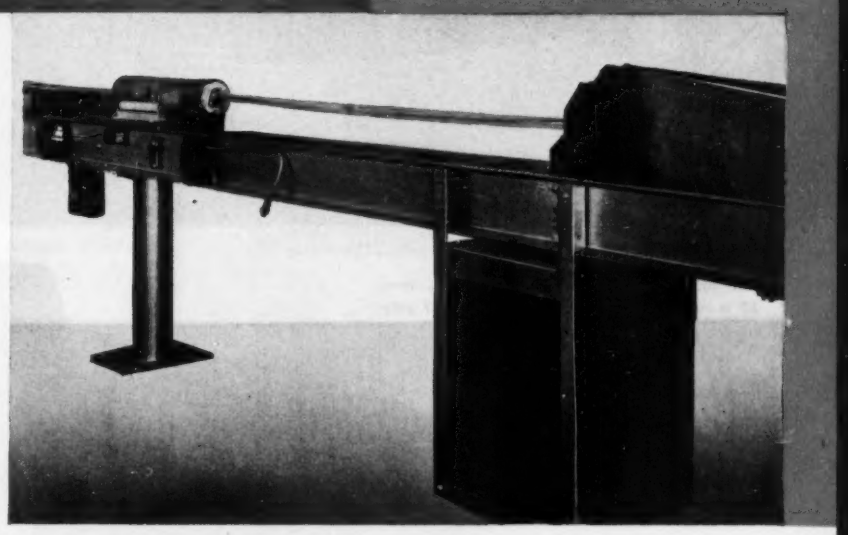
Building and Construction—To complement the translucent reinforced plastics glazing and structural panels (see "Boon to Builders," MODERN PLASTICS *31*, 87, Nov. 1953), rods, tubes, and angle stock can be used to brace, frame, support, and fasten these panels. Angle stock, which is manufactured in almost any combination of leg length and thickness, will also soon be on the market as a lightweight window frame and sash that never sticks, rusts, rots, or conducts heat. Channel sections can be used as the slide or frames for sliding doors, windows, and screens.

Concrete Reinforcement

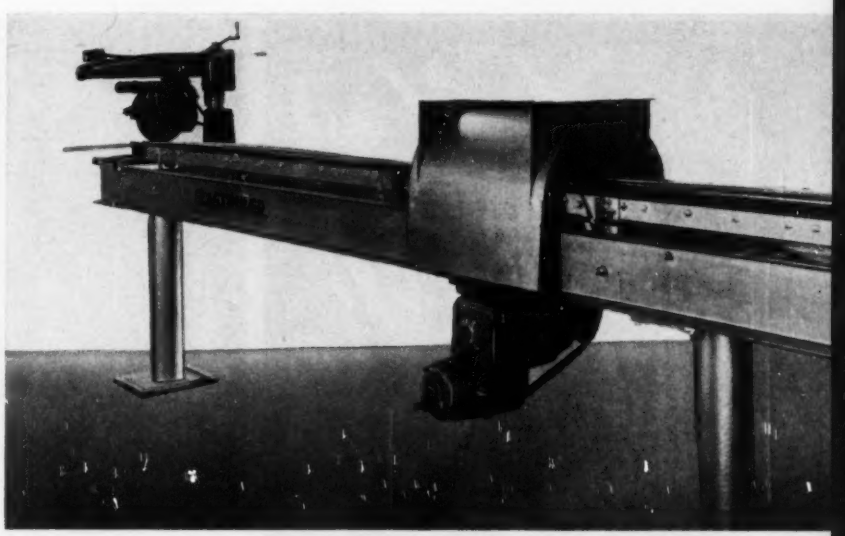
Development work is now in progress on the reinforcement of concrete with non-corrosive, high tensile-strength reinforced plastics rods as a replacement for steel rods presently used.

Miscellaneous—Other industries, civilian as well as military, are potential markets for reinforced plastics helicopter blades, aircraft controls, sign posts, umbrella shanks, ladders, fences, and numerous other items.

Judging by this host of potential and actual applications, the impact of this development will not only be upon the reinforced plastics industry itself, but upon all the industries it can serve by producing a specialized product to perform a specific job.

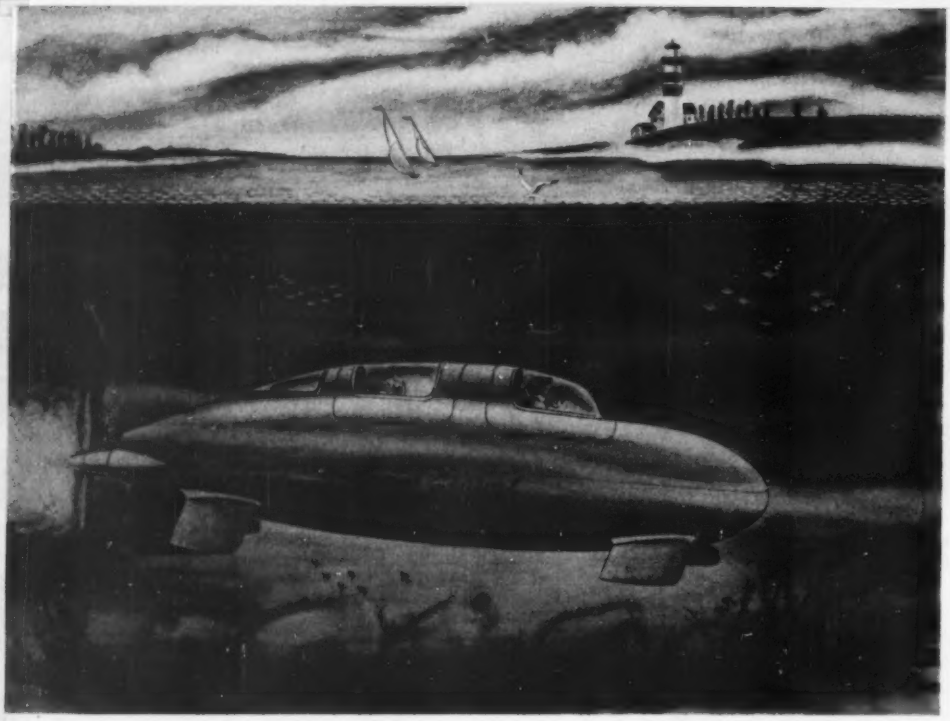


Still under carefully controlled tension, the impregnated fibers travel from forming die into curing die (left) where a high frequency current is applied for heat curing



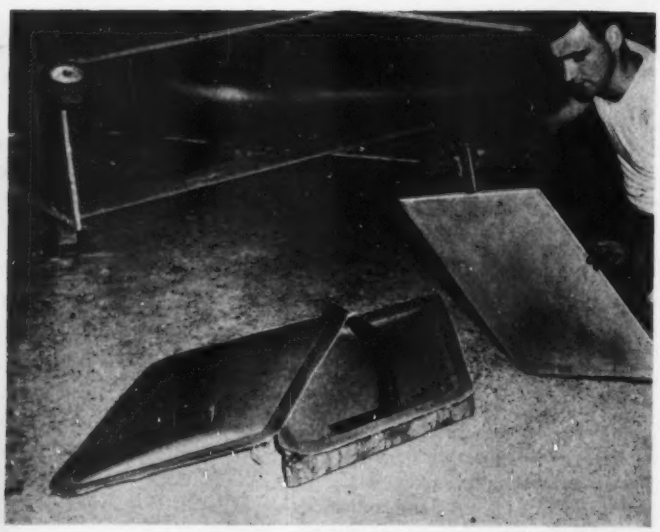
Finally, the cured sections are conveyed through the pulling machine (under housing, center) to an abrasive saw (left) which cuts the stock off at predetermined lengths

The



Hull of miniature submarine, 12½ ft. long, 22 in. wide, and 42 in. high, is made of polyester impregnated glass cloth and mat

Complete submarine hull mold consists of bottom half (left) and top half, shown below in their working cradle



Complete rudder (right), formed by fusing together two sections around a rudder shaft (left), is also made of glass-reinforced polyester resin

MiniSub

Two-man submarine is made of reinforced plastics in reinforced-plastics molds

ONE of the newest reinforced plastics applications, the MiniSub weighs only 155 pounds. Capable of traveling several miles under water and of duplicating every maneuver of an airplane (including a loop at a 25-ft. depth), the MiniSub is 30 times as efficient as a swimmer with rubber fins on his feet.

It provides a new instrument for oceanic exploration and may be used for inspection of harbor facilities and as a sports submarine by skin divers.

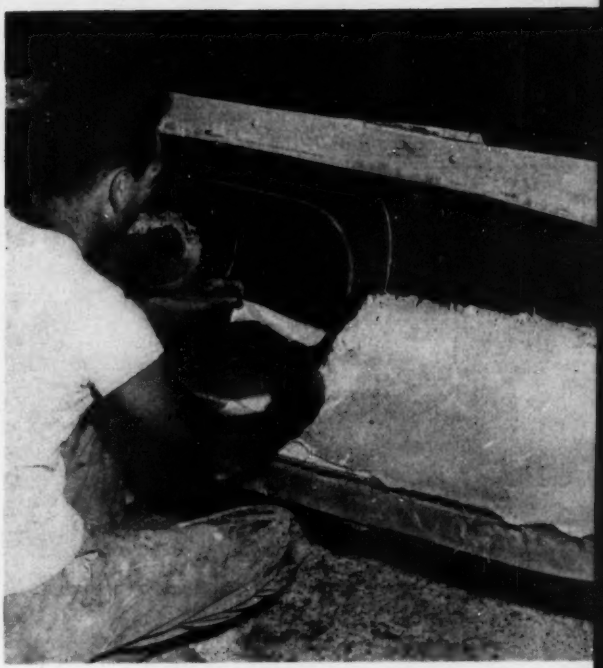
When in actual use, the hull is "free-flooded," being not only underwater but also full of water. The pilot wears a face mask with breathing unit, steering by means of a triaxial control stock. Acrylic canopies provide good visibility and also serve as access hatches. Power is through counter-rotating propellers driven by foot pedals or by a 1-hp. electric motor. Top speed is 6.3 m.p.h. with pedals, 7.25 m.p.h. with motor.

Molding of the MiniSub is by wet lay-up process, using single female molds which are themselves made from fibrous glass reinforced plastics.

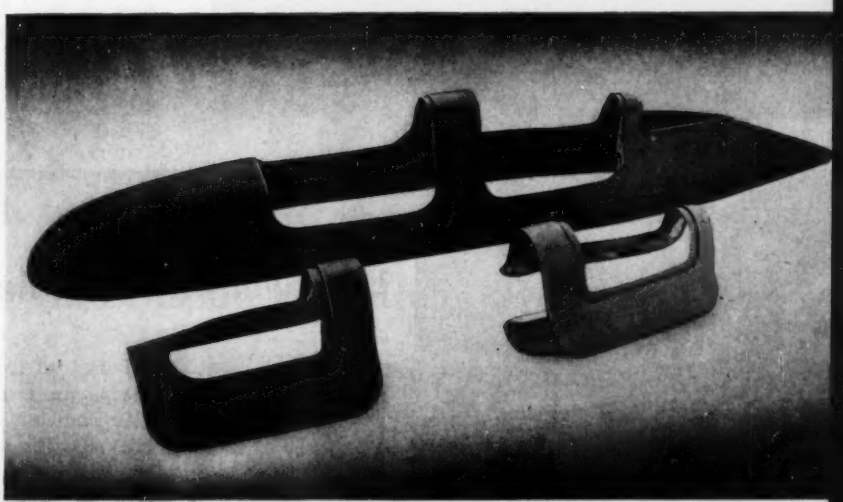
The shell is literally a sandwich involving one layer of glass cloth on each side of a layer of 2-oz. glass mat. Curing is accomplished by catalysis.

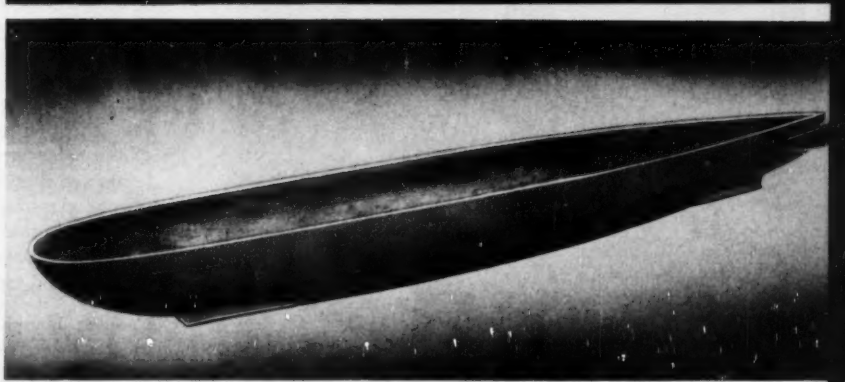
The submarine is 12½ ft. long, 22 in. wide and 42 in. high, with two sets of fins, fore and aft, each 45 in. wide.

CREDITS: MiniSub designed and developed by Aerojet-General Corp. at Azusa, Cal. Co-inventors are Calvin A. Gongwer, manager, and George M. McRoberts, chief engineer, of Aerojet-General's Underwater Engine Div. Plastics engineering by John A. Wills and Co., Pasadena, Cal. Molded hulls by Dudley Machinery Corp., Pasadena. Laminac polyester resin was used with Fiberglas. Dzus fasteners are used in assembly.



Fibrous glass material for sandwich construction of hull (2-oz. layer of glass mat between two single layers of glass cloth) is tailored in mold



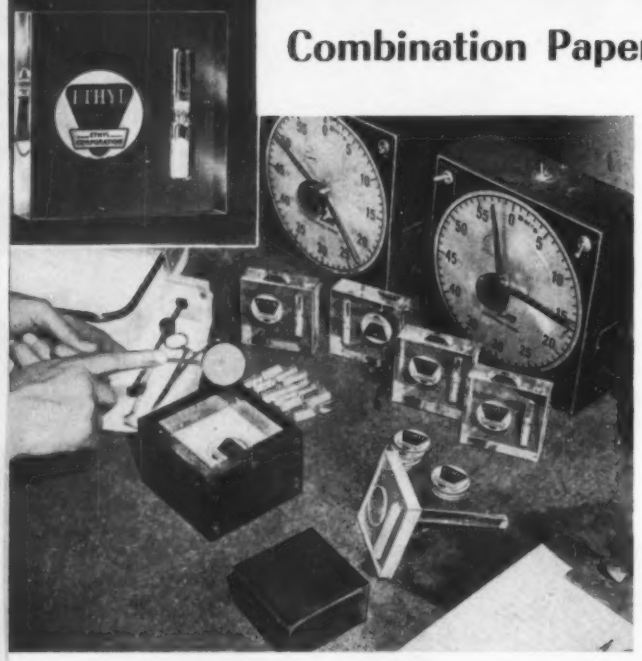


All photos with this article courtesy Aerojet-General Corp.

Finished parts of upper half (top) and lower half of hull were molded by "wet lay-up" process; fastening of the various components is accomplished by mechanical means

PLASTICS

Combination Paperweight and Telephone Timer

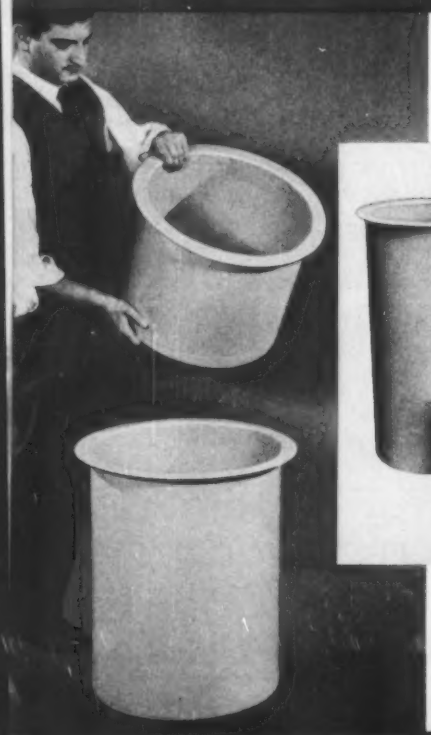


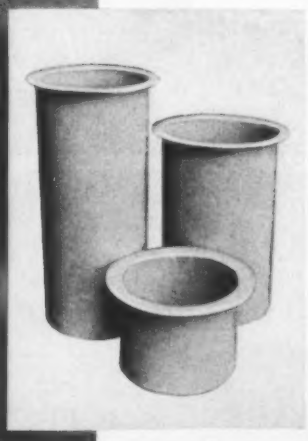
Attractive desk ornament serves as a combination paperweight and three-minute telephone timer. The one shown was molded for Ethyl Corp., and distributed to employees as a reminder to keep long-distance phone call times within minimum charge limits.

The product is compression molded of finely granulated acrylic powder using a simple mold. The powder is introduced into the mold to sufficient depth and then tamped with a die that forms depressions for accurately locating the decorative seal and the timer. After the seal and timer are placed in position, an equal amount of molding powder is added. The force plug is then positioned in the mold and pressure of 400 p.s.i. is applied; molding temperature is 350° F. After cooling, the piece is removed from the mold and deflashed. No further finishing operation is required. Scoring of the molded piece is held to a minimum by the use of hardened chrome-plated molds.

CREDITS: Molded by Creative Plastics Corp., Stony Brook, L. I., N. Y. Acrylic powder by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Lightweight, Chemical-Resistant Crocks





Industrial crocks and containers available in a range of sizes are made of Iolyte, a polyester resin and fibrous glass combination which, pound for pound, has the tensile strength of steel. The lightweight, shatter-proof crocks are resistant to most corrosive process materials. Cylindrical in shape—not tapered—the fabricated crocks have capacities ranging from 5 to 125 gal., with diameters from 8 to 28 in., and are produced in heights from 12 to 48 inches.

Fabrication of the crocks involves postforming cured sheets of polyester resin and fibrous glass mat. Shaping of the sides is accomplished in split female molds. The joints are then securely bonded with resin impregnated fibrous glass tape. The final assembly consists of die cutting the bottom section and flange from flat sheets of Iolyte which are then adhered to the cylinder with resin impregnated tape.

CREDITS: Manufactured by Schori Process Div., Ferro-Co. Corp., 8-11 43rd Rd., Long Island City, N. Y. Polyester resin by Celanese Corp. of America, New York, N. Y. Fibrous glass by Owens-Corning-Fiberglas Corp., Toledo, Ohio.

PRODUCTS

Preformed Modeling Kits

Modeling kits contain vinyl resin-base plastigels preformed into basic shapes to give children a start in creative endeavors. The modeling material, called Pyrocon, is non-sticky, soft enough to be easily molded, and can be worked repeatedly without drying out. It is nontoxic and resistant to most chemicals. The preformed sections can be gently kneaded and combined to create human figures, animals, automobiles, etc.

If a permanent model is wanted, the molding is placed in a baking dish or tray and inserted into an ordinary kitchen oven or roaster preheated to 350° F. After baking for 15 min., the piece is removed and allowed to cool. The finished product is tough and, under normal usage unbreakable. The kits contain additional Pyrocon in red, yellow, blue, brown, green, terra cotta, white, and black which can be combined for different colors and effects. Finished objects may also be colored with crayons or paint.

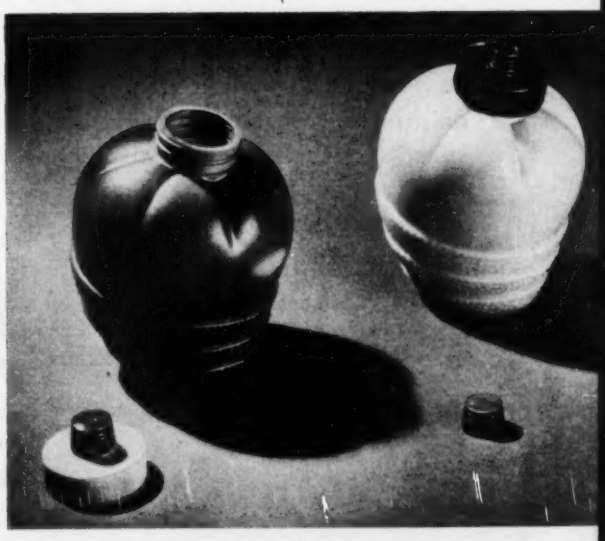
CREDITS: Made by General Glaze Corp., 1602 Union Ave., Baltimore 11, Md. Vinyl resin-based plastigels by Bakelite Co., New York, N. Y.

Leakproof, Squeezable Dispenser With Dripless Spout

Squeezable container called the "Little Squirt" will dispense liquids of all viscosities. Pressure on the flexible dispenser forces an even flow of ketchup, mustard, salad oil or dressing, vinegar, or any other table liquids through a dripless pouring spout. Two caps are used to seal the unit. Larger cap has a sealing ring molded into its base to form an airtight coupling; other side of cap has the dripless pouring spout. A smaller cap threads over the pouring spout and serves to close the unit. The container has a wide mouth for easy filling.

The dispenser is blow-molded of polyethylene and the caps are compression-molded of urea in 13-mm. and 35-mm. sizes. The 13-mm. cap is stock molded; 35-mm. cap is molded from a private mold. The units are available in red and green.

CREDITS: Bodies by Plax Corp., Hartford, Conn., for General Flexware Corp., 64 W. 23rd St., New York, N. Y. Polyethylene by Bakelite Co., New York, N. Y. Urea by American Cyanamid Co., New York, N. Y. Caps by Wheeling Stamp Works, Wheeling, W. Va. and Armstrong Cork Co., Lancaster, Pa.



DIG

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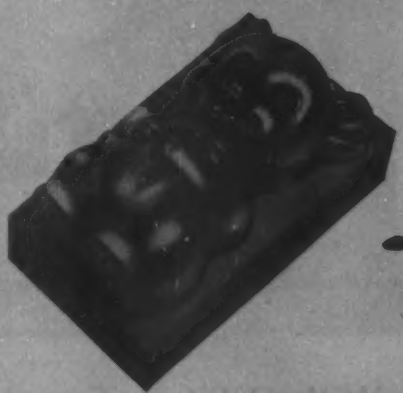

operations on steeply inclined surfaces in close quarters. We can duplicate 1 to 1, or reduce, or enlarge, in 2 or 3 dimensions, better and faster than it was done before. You get excellent surface finish on concave, convex, cylindrical, spherical or conical parts, with practically no hand finishing required. This means less tooling delay, a clean initial die, faster production . . .

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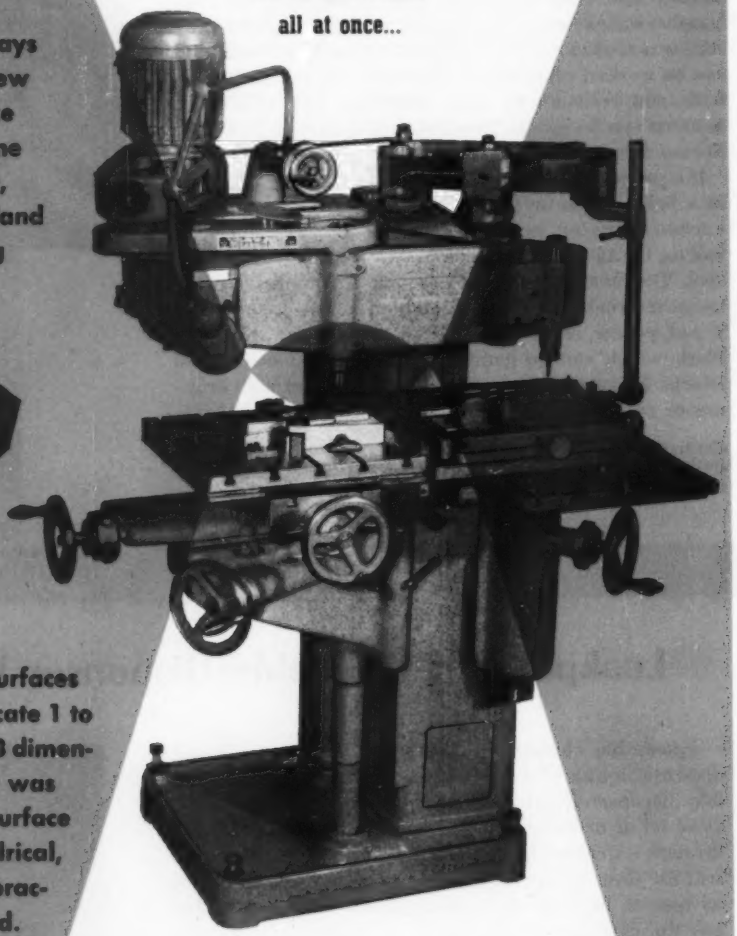

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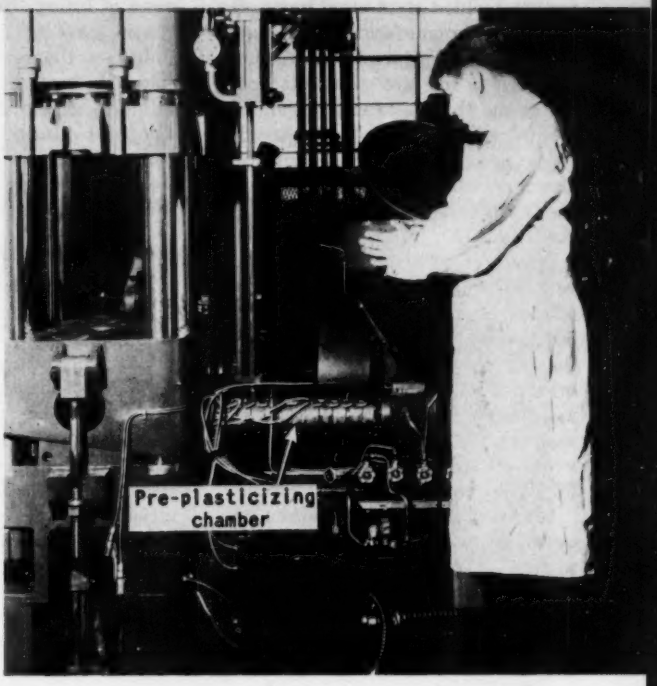
Injection Molding Rigid Vinyl

New molding equipment and techniques foreshadow expansion in new markets for plastics



Preplasticizing cylinder, extending from hopper to injection chamber of machine, works material into uniform viscosity

LATEST development in the injection molding of thermoplastics is a method of successfully producing molded parts of rigid polyvinyl chloride. The processing conditions for rigid or hard vinyls are most critical. Because of this, and because of the general lack of processing know-how, expansion of the rigid vinyl plastics market has been greatly handicapped.

Processing difficulties were pointed up in a paper[1] presented by C. E. Parks[2], from which the following abstract is quoted:

"Experience to date indicates that the fundamental flow properties of unplasticized high molecular weight vinyl resins are such that injection molding of the conventional type is impossible. These materials are very dry, tough, and highly viscous even at high temperatures. When heated in a static condition the resins soften progressively until a temperature of 350 to 360°F. is reached, but even then are not in proper flowing condition. Increasing the temperature still further will cause internal chemical reaction (probably cross linking) and decomposition, but will not appreciably increase the flow properties.

"Rigid vinyls are apparently somewhat thixotropic and their viscosity can best be reduced by efficient agitation. Such agitation can be accomplished by an extruder. An extruded vinyl rod cut to proper length while still hot (360° F.) and placed in a transfer mold with minimum loss of time exhibits the best flow properties and makes the strongest molding of any method tried to date."

Pipe Fittings Molded

A fair volume of rigid vinyl pipe has been extruded, but its use—and therefore its production—has been limited by a lack of satisfactory threaded pipe fittings of the same material. True, some fittings have been produced by transfer molding but they were costly because the production rate of molding any thermoplastic by this method is comparatively slow and material waste is high.

Several years ago, an injection machine was built which, although it was not realized at the time, would eventually lead to injection molding of rigid vinyl pipe fittings at satisfactory production rates. Such fittings can withstand the most severe burst-strength tests; at the same time, they are not subject to corrosion and are lower in cost than metal fittings. Tests have proved that these rigid polyvinyl chloride fittings have approximately doubled the conventional 8-to-1 burst-strength safety factor based on 150 p.s.i. pressure. Rigid vinyl pipe and fittings are especially suitable for use in chemical plants, paper mills, and other installations where conveyance of corrosive acids is a serious problem.

The machine that has made this production possible is based on one built some years ago by Jackson and Church Co., incorporating the Hendry preplasticizing system which consists of an extruder-preplasticizer feeding into an injection chamber. In principle, this injection machine meets the requirements laid down by Mr. Parks for successful molding of rigid vinyl and at the same time

* Reg. U.S. Pat. Off.

[1] Presented at a joint meeting of the Quebec Rubber & Plastics Group, Quebec Section of The Society of Plastic Engineers, Inc., and The Society of the Plastics Industry (Canada) Ltd., Montreal, P. Q., Canada, Apr. 16, 1953.

[2] B. F. Goodrich Chemical Co., Avon Lake, Ohio.

eliminates the inherent difficulties associated with transfer molding of the material.

Later, realizing the need for injection-molded rigid vinyl parts, the machinery manufacturer designed, on the same principle, a machine specifically for this work. It comprises the three elements previously mentioned: the horizontal extruder feeds into the vertical injection chamber which in turn feeds fully plasticized material into a vertically clamped mold.

Several revolutionary changes in vertical press injection molding are offered by this new machine. Most outstanding innovation is the stationary lower platen which permits injection of the material into the mold from the bottom, making the machine the first of this type. Conventional vertical machine molds are filled by injection from the top.

By injecting from the bottom, the press becomes "down-acting" and instead of sucking the oil upward, like older vertical machines, the oil plunges downward from the overhead storage reservoir, permitting the traverse part of the cycle to be speeded up. Early tests proved that the movable upper platen is advantageous because it makes automatic operation possible, if desired, by dropping the parts from the mold instead of lifting them out.

Also speeding up the cycle is the ability of the screw, extruding the material through the preplasticizer cylinder to the injection chamber, to operate during the hold time of the machine, the opening time, and the period required to remove parts from the mold.

Uniform Viscosity

The Hendry process uses no torpedo in the injection chamber. Instead, it depends upon the preplasticizer for getting the material into uniform viscosity, ready for injection. Extending from the hopper to the injection chamber of the machine, the screw operates at any desired speed to mull the plastics material prior to injection. The result of this is a thorough mixing and heating, allowing the material to be injected into the mold at more constant temperatures and lower pressures. This mixing action produces the "agitation" mentioned above as desirable in working with rigid vinyls.

The preplasticizing chamber is equipped with two independently controlled heating zones. The injection chamber has another heating zone. Lower resistance-heater temperature settings protect the material against discoloration and decomposition, while the mulling action produces frictional heat which assures thorough plasticization.

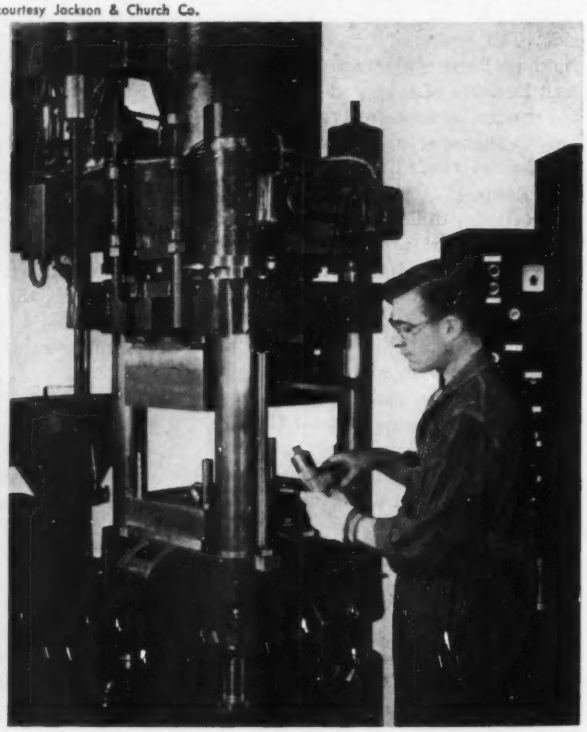
As the screw turns, new segments of material are constantly brought into contact with the heated cylinder.

Two 4-kw. heaters provide most of the heat, but are augmented by controlled frictional heat produced by the action of the high compression ratio screw (23-to-1). This makes the unit a constant viscosity rather than a constant temperature device. Another 4-kw. strip heater maintains a constant heat for material in the injection chamber.

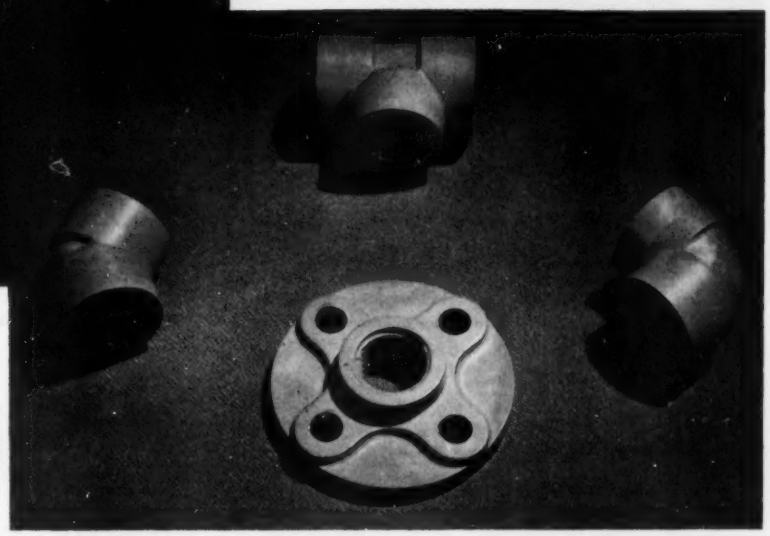
After being extruded into the injection chamber by the screw, the constant viscosity material is shot into the mold by a hydraulically operated ram. The injection ram on the press is 1.5 in. in diameter. Maximum injection chamber pressure is 38,000 p.s.i. Clamping of the

Two-in., 90° elbow fitting (left) and 1-in. "T" fitting (right) being removed from injection molding machines. These machines are unique in that they have stationary lower platens. This construction permits injecting material into mold from bottom, making for faster cycles

All photos with this article courtesy Jackson & Church Co.



Meter reads 2850 p.s.i. in pressure test of "T" fitting, twice the conventional burst-strength safety factor



Rigid P.V.C. fittings are molded in "T's" (top, center), 45 and 90° elbows (left and right), and flanges

mold is by hydraulic action only and involves no toggle joints or levers. The clamp pressure is 150 tons with a 12-in. stroke.

Molding Conditions

Successful operation of this equipment did not come overnight. It was over a year before satisfactory parts were produced. The actual operating conditions which have been found most successful are as follows: The three heat zones of the extruder type preplasticizer are set at 170° F. for the first zone, 250° F. for the middle zone, and 280° F. for the third zone. As the material enters the injection chamber it has reached a temperature above 350° F.

Thus it can be seen that a great deal of work is done on the plastics material by the extruder, since the temperature of the material is over 70° higher than the highest temperature on the preplasticizer cylinder. Of course, this temperature increase is caused by frictional heat. The injection chamber is held at a uniform temperature above 350° F. and the material is injected into the mold at this temperature. A Thermolator temperature control unit is used to hold mold temperature at 130° F.

Using a two-cavity mold for a 1-in. "T" pipe fitting as an example, the over-all cycle time is 2 min., broken down as follows: Slightly less than 1 sec. for injection, hold time 15 sec., and cooling time 85 seconds. The balance of the cycle time is consumed in opening the mold, removing the fittings and threaded mold insert parts, placing in the mold a second set of removable threaded mold parts, and closing the mold.

First installation of injection molded pipe fittings produced by this machine has been at a chemical plant which used nearly 7000 pieces including "T's", 45 and 90° elbows, and flanges for ½-, ¾-, and 1-in. pipe sizes. One of the nation's largest rubber firms has made use of 10,000 fittings. According to the molder, these quantity orders are very small in comparison with sales potentials. Engineers working on the project visualize eventual production of fittings for 12-in. pipes.

This development in molding equipment and techniques may well be the cause of another plastics expansion cycle such as occurred with the introduction of calendered film. With molded parts now available, new large-volume applications may well be found which will enable rigid vinyls to compete in markets presently outside the plastics field.

Weight of these injection molded 2-in. 90° elbow fittings is 10 oz. each

All photos with this article courtesy The City Auto Stamping Co.

1 Preform screen is mounted on rotating table in plenum chamber of preformer prior to addition of glass and binder

2 At end of the preform cycle, chair base preform of resin-bonded chopped glass is ready for removal from machine

Molding Swivel Chair Bases

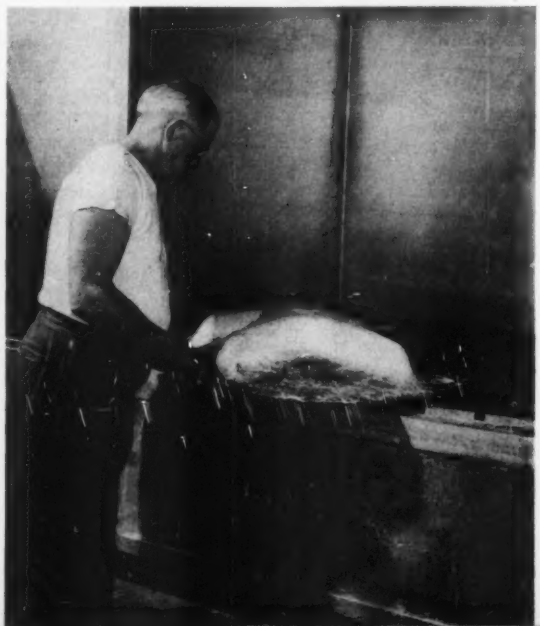
Impregnated fibrous glass preforms are molded in single-cavity matched metal molds

OFFICE swivel chairs now have bases made of reinforced plastics. The Sturgis Posture Chair Co., Sturgis, Mich., began to investigate the possibilities of plastics three years ago. Various plastics materials were evaluated as to their physical properties, and on the basis of these results it appeared that reinforced plastics came closest to meeting all requirements.

Samples of reinforced plastics molded parts were collected and sections of these parts were used to run a series of tests at the University of Michigan. Such properties as compression, flexural-shear and tensile strengths, and resistance to abrasion and marking were studied. All results indicated that, if properly designed, a reinforced plastics chair base could be made which would be superior in all respects to any previously made of either steel or aluminum.

Almost a year of experimental effort was required to reach the point where chair bases of fibrous glass and pigmented polyester are now being molded on a production scale by The City Auto Stamping Co., Toledo, Ohio. Sturgis is so confident of the high quality of these bases that the company guarantees that the bases cannot be dented, permanently deformed, or disfigured.

Preforms for the base are produced on a special vacuum type preforming machine. A perforated steel



3 Preform, still on screen, is placed in oven and baked for about 3 min. to set binder; it is then strong enough to be separated from the metal screen

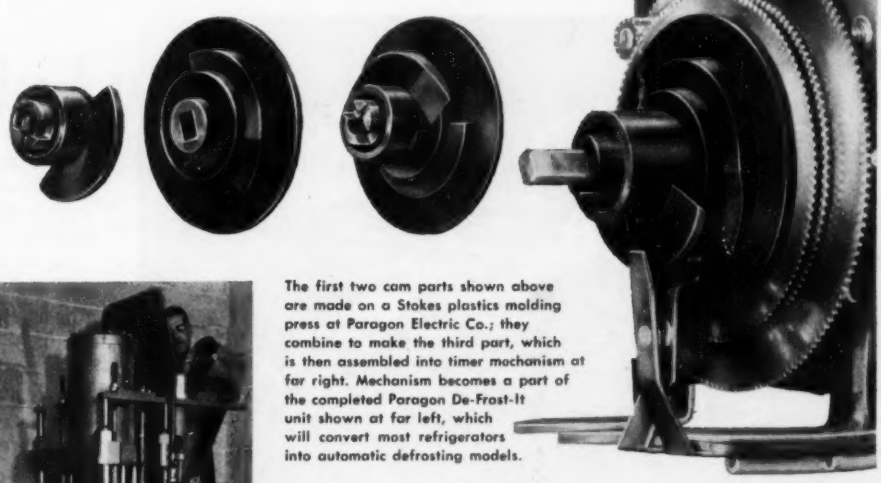
How One Manufacturer Saved 83% on Plastic Molded Parts

Cost per set of plastic timer cams was reduced from 6¢ to 1¢ . . . production per hour increased from 575 to 720 sets . . . savings boosted to $40,000 per year . . . when a Stokes fully automatic plastics molding press was installed at Paragon Electric Company, Two Rivers, Wisconsin.

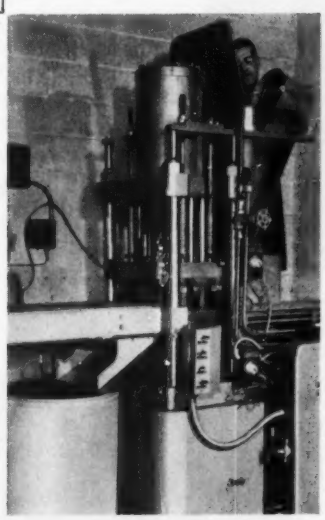
Paragon first produced an outlet assembly for the bottom of its De-Frost-It unit, an automatic refrigerator defroster, on its new Stokes Model 741, 50-ton press. Then came two plastic timer cams . . . intricate in design . . . requiring a knife-sharp edge at one point. All parts were produced with complete success . . . mold costs completely liquidated . . . labor cost reduced to the vanishing point.

Send your parts or blueprints to Stokes Advisory Service for report on their suitability to fully automatic molding, and a free detailed product cost analysis. Also send for the Stokes 24-page brochure on Fully Automatic Molding.

F. J. STOKES MACHINE COMPANY PHILADELPHIA, 20, PA.



The first two cam parts shown above are made on a Stokes plastics molding press at Paragon Electric Co.; they combine to make the third part, which is then assembled into timer mechanism at far right. Mechanism becomes a part of the completed Paragon De-Frost-It unit shown at far left, which will convert most refrigerators into automatic defrosting models.



Operator fills the hopper of the Stokes Model 741 plastics molding press at Paragon Electric Co. This one operation, performed once every eight hours, is all the attention the press requires.

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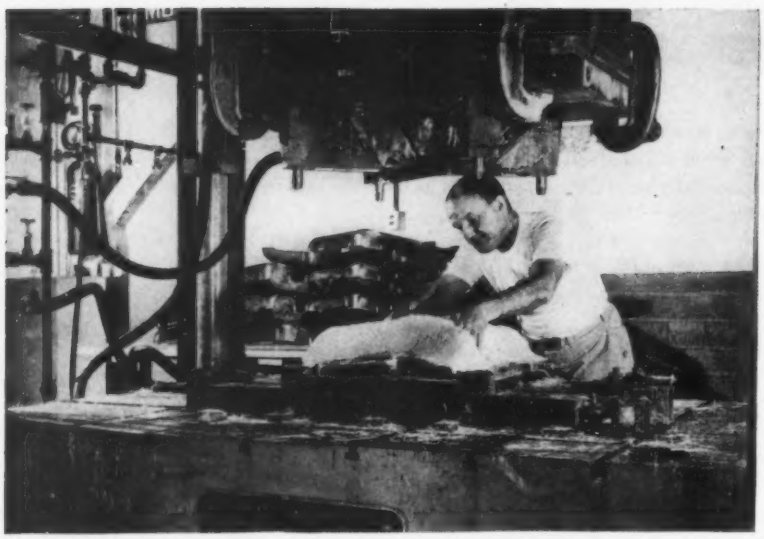


4 Separated preform, its interior saturated with a measured quantity of impregnating resin, is ready to be placed on male half of matched metal mold

5 After less than 2-min. curing time, mold is opened and chair base removed. Excellent cut-off of this mold is shown by small amount of flash at parting line

screen is first fabricated to the size and shape of the inside contour of the required preform. This screen, after mounting on a suitable base, is then placed on a rotating table which is mounted in the plenum chamber of a Brenner preformer. Figure 1 shows the chamber door open and the preform screen mounted in position. The rotating table is so constructed that a vacuum may be drawn through the openings in the preform screen. The preformer is also equipped with a rovings cutter to chop the rovings into predetermined length. As these chopped lengths of rovings are fed into an opening at the top of the plenum chamber they are drawn by vacuum onto the surface of the perforated screen. The weight of chopped glass which is fed into the plenum chamber is controlled by a timer, so that whatever amount is required is automatically metered. During the build-up period, a resin liquid binder is automatically sprayed on the preform.

The preform screen, with a built-up preform in position on it, is shown in Fig. 2. In order to set up the binder and give the preform sufficient strength for handling, it is necessary to bake it in an oven (Fig. 3) for approximately 3 min. at 350° F.

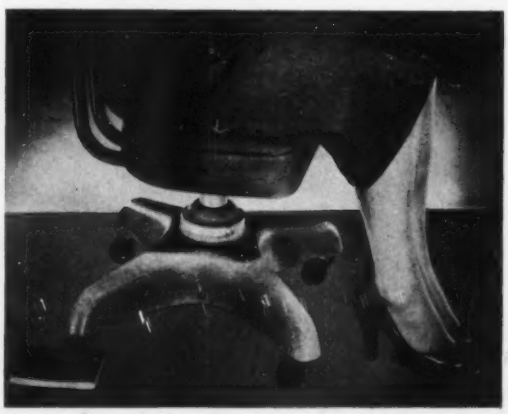
After the baking period, the preform is separated from its screen and is ready for the molding operation. The screen is returned to the preformer.

Matched Metal Mold

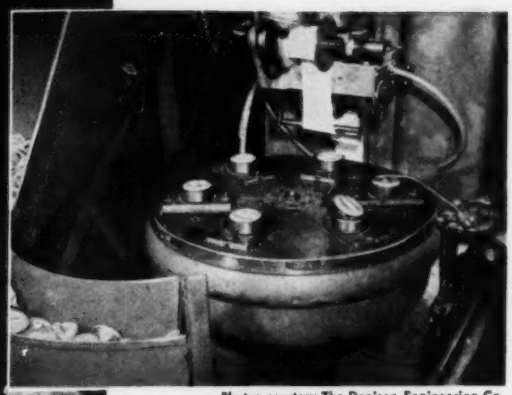
For this job, a single cavity matched metal mold is used with the force plug mounted on the base and

(*Continued on p.* 212)

An important feature of this reinforced plastics swivel chair base is the pleasing pattern of glass fibers, which adds to the decor of the modern office



Even with a book placed under one of the casters, the other three casters remain on the floor because of the flexibility of the molded material



Photos courtesy The Denison Engineering Co.

Cams located around perimeter of six-station index table actuate air lines

Molded knobs are hand-fed into key-slotted dies for proper positioning

Automatic Embossing

Hydraulic press installation, designed for automatically embossing and coloring molded knobs, cracks production line bottleneck

EVERY production man knows that it is not always the most complex component of his product that leads to bottlenecks in the manufacturing operation. One large appliance manufacturer, Nash-Kelvinator Corp., was faced with one inefficient operation in its Milwaukee plant that seemed almost insignificant compared to the tremendous forming and enameling jobs involved in the production of ranges, refrigerators, and other appliances. This bothersome bottleneck was the marking of thermoplastic control knobs.

Using hypodermic needles, a crew of operators tediously filled the various letters and numerals molded-into the knobs with paint and then wiped off the excess. In addition to the difficulties of making the markings uniform, this production step was far out of pace with the rest of the plant's efficient and speedy operation.

After working on the problem for some time, the company's engineers decided upon a new approach—molded plastics knobs that would not have any letters or numerals molded-in but which would have all markings automatically machine-embossed and colored after the molding operation.

The press selected to perform the embossing job was a hydraulic Multipress, made by the Denison Engineering Co., Columbus, Ohio.

The force of the Multipress ram is preset, and is imposed only after the ram has come in contact with the work. This means pressure is absolutely uniform on each stroke despite possible variations in the dimensions of the work. Dwell period on the ram is easily controlled. This particular operation requires a ½-sec. dwell.

To complete the change-over from a hand operation to an automatic one, the company equipped the press with a Denison-developed and built hydraulic index table and foil-marking device.

The index table is perfectly synchronized with the ram cycle, since its power is derived from the press hydraulic system. Once the speed of press operation is determined, the index table will feed at this precise preset rate.

The molded knobs are placed in a hopper at the left side of the six-station index table and hand-fed into the key-slotted dies. This keyway insures the face of the dial being in the same relative location for each knob. As the table indexes, the die is carried under the ram which exerts ½-ton pressure. The foil-marker is mounted directly on the press ram, and automatically feeds fresh foil at each stroke.

After being embossed and marked, a cam-riser at the first station past the ram lifts the parts from its seat. At the next station, a cam-actuated air blast blows the finished piece into an off-bearing chute.

As an added safety precaution, the diameter of the index table is large enough so that the operator feeding the press is never near the ram. Since the operator can feed the index table at a position directly opposite the ram, hands never need be brought anywhere near the cycling ram or the heated foil-marking platen mounted on it.

The new hydraulic press method now marks 800 parts per hr. with only one operator needed. Six different jobs are handled on this one press, with no rejects due to unevenness of marking or fill. Tooling is readily changed by removing a pair of bolts on each die set.

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STYRON 666 is an all-around general-purpose polystyrene developed to provide maximum property values in the end product with maximum ease and speed of fabrication.

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Technical service bulletins are available for more detailed information on the Styron formulations. Write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Dept. PL 1412-B.

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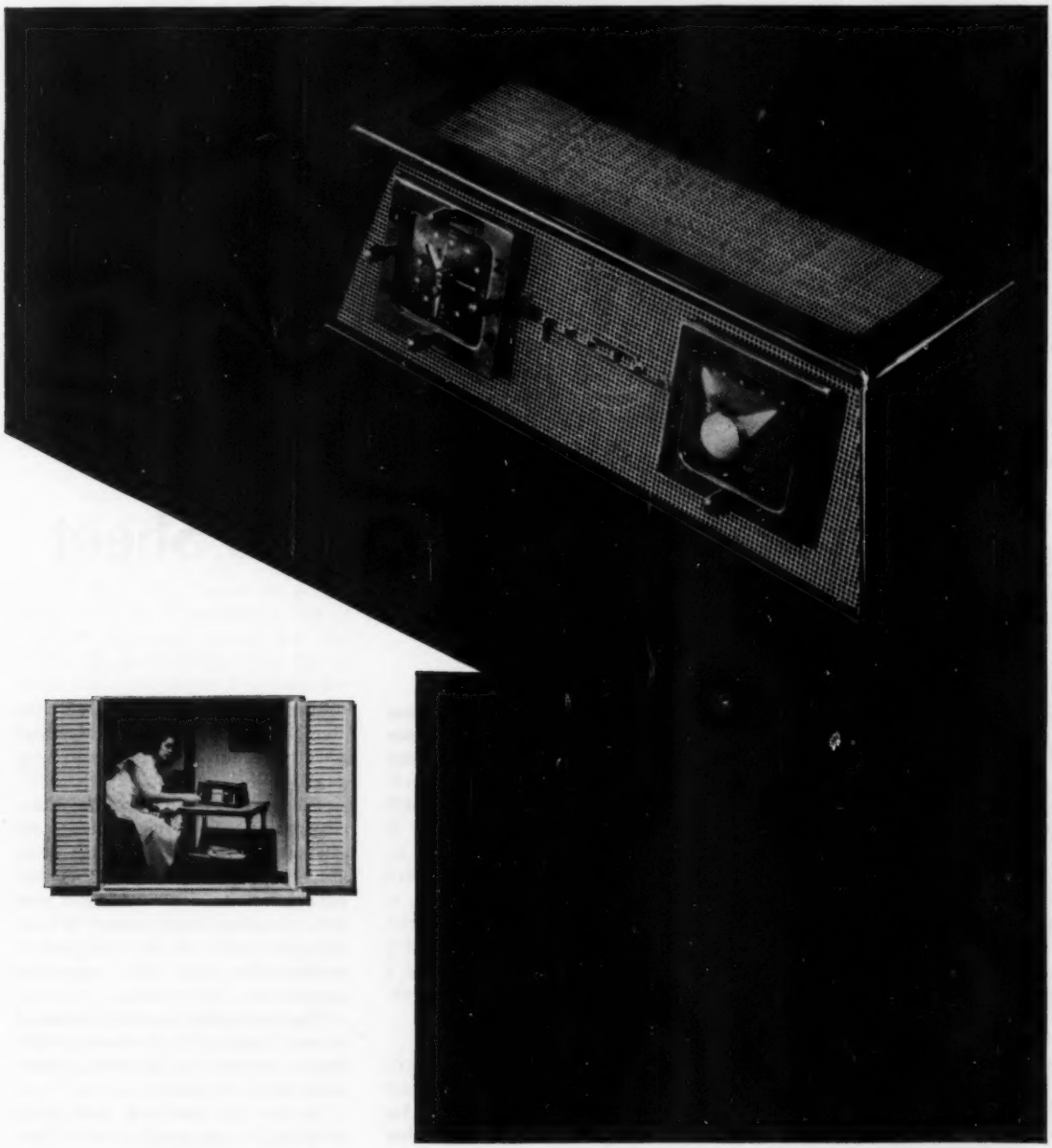

Sparton Radio Cabinet molded by Chicago Molded Products and Detroit Macoid Corporation for Sparton Division of Sparks-Withington Co.

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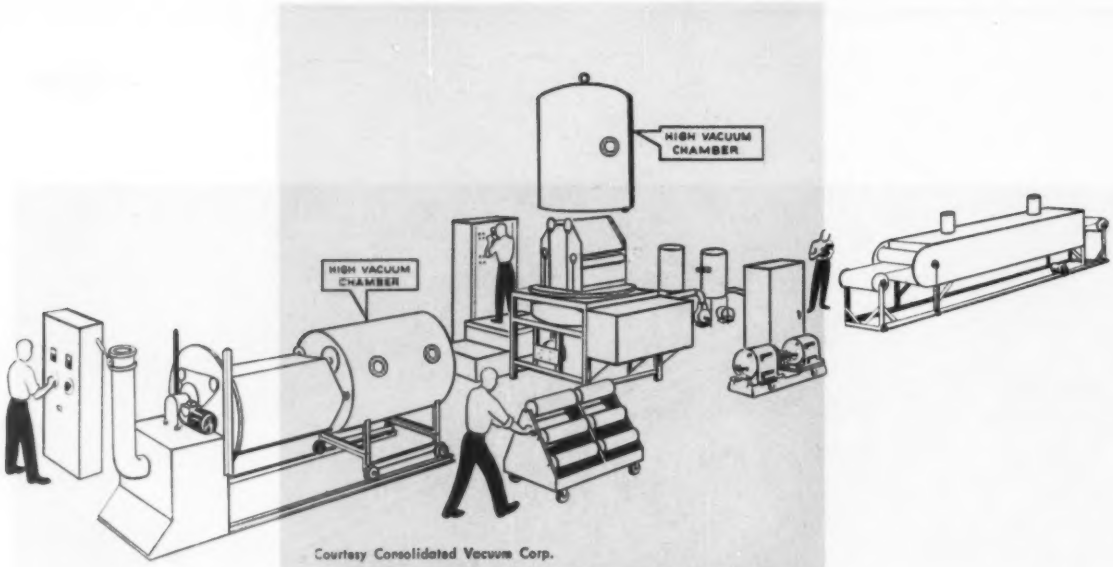


Courtesy Consolidated Vacuum Corp.

Process sketch of sheet metallizing operation shows degasser (left), roll coater (center), and lacquer coater (right)

Vacuum Metallizing of Plastic Sheet

by **Dr. G. H. Bancroft***

HIGH vacuum is making it possible to apply a thin, but highly reflective and long-lasting coating of metal to various kinds of plastic sheet material quickly, easily, and economically. The metal-coated sheet is used for a wide variety of ornamental purposes, including such things as sequins, Christmas ornaments and decorations, printing stock for advertising displays, wrapping paper, and book stamping and other transfer applications.

Equipment that is commercially available accommodates rolls of material up to 26 in. wide and applies a film of metal approximately five millionths of an inch thick.

Aluminum is most commonly used as the coating metal, principally because of its high reflectivity and its resistance to oxidation. However, silver, and occasionally some other metals, have been used.

The coating is applied by vaporizing the metal in a high vacuum chamber and condensing the vapor on the surface of the plastic sheet. It can, of course, be applied to one or both sides of the sheet, as desired, but a one-side coating is sufficient for most purposes. Although the metal film adheres well, it is so thin that it generally is protected by overcoating with lacquer, which may be clear or may be dyed to produce virtually any color desired. Most common method of applying the lacquer is to roll it on by a method similar to the offset printing process.

Coating Bases

Acetate and styrene sheet are used most frequently as bases for the metal coating; each material has advantages and disadvantages. Polystyrene requires less preparation before the coating operation since it contains less residual plasticizer or solvent, whereas acetate is favored by some users because, they say, it has a glossier surface and therefore yields a more brilliant finish. Other films, such as Mylar, are being considered, but high basic material cost makes them prohibitive even though they handle well under high vacuum and can be metallized readily.

The vacuum equipment for quantity production of metallized plastic sheeting of the type used for decorative applications consists of two separate units, each having a vacuum chamber large enough to contain the rolls of material, rolling mechanisms, and other apparatus required for the process.

The accompanying sketch shows a typical layout of a vacuum metallization process for depositing aluminum on plastic sheet.

In the first operation, the plastic sheeting is continuously rolled back and forth under a vacuum of approximately a half-millionth of atmospheric pressure until all volatiles have been removed. A photoelectric device automatically reverses the rolling mechanism when the end of the roll is reached, and a glow discharge electrode facilitates the removal of volatile materials from the plastic. Also, electric

* Consolidated Vacuum Corp., Rochester, N. Y.

heating elements are sometimes placed in the chamber near the main sheet to speed out-gassing. With acetate material, the degassing period usually is about 3 hr., while styrene ordinarily requires approximately 1 hr. or less. Maintenance of the desired degree of vacuum is the accepted method of determining when degassing has been completed.

After the degassing operation, the roll of plastic sheeting is transferred to the vacuum coating unit. In that chamber a combination of speedy mechanical and diffusion pumps pulls the pressure down to about 1/1,500,000th of atmospheric pressure in about 15 minutes.

When the desired vacuum has been produced, high-frequency (9600 cycles) current is applied to induction coils surrounding a number of graphite crucibles, each containing several ounces of type 25 aluminum. In 5 to 10 min. the aluminum becomes molten and begins to vaporize quite rapidly, with the vapor disseminating in straight lines from the molten source and condensing on the first surface it touches. The crucibles are positioned about 10 in. below the plastic sheet, in order to produce a film of uniform thickness across the full width of the material. For 26 in. wide material, three crucibles are required; narrower sheets can be coated with two.

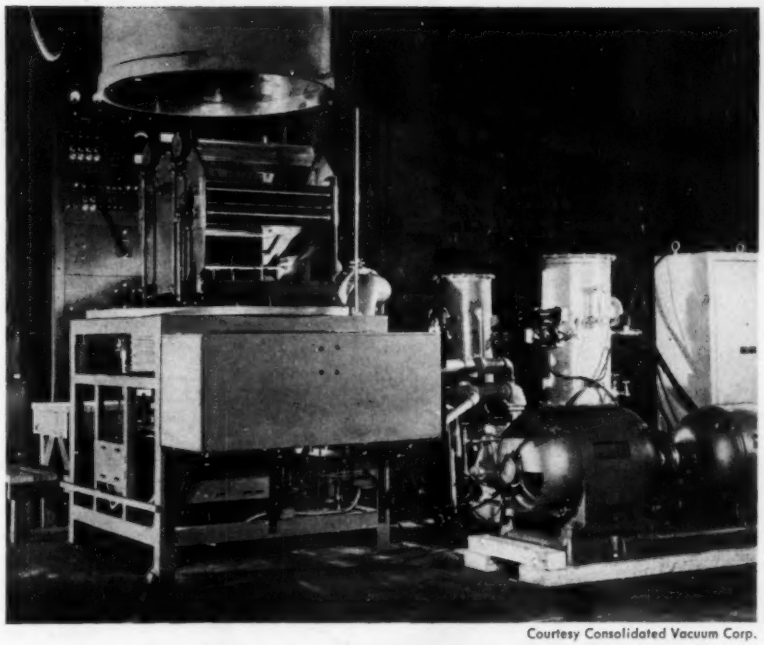
Operation

While the crucibles are being brought up to operating temperature, a sheet metal shield protects the plastic sheet, which, up to that time, has remained stationary. As soon as vaporization of the metal is proceeding at a satisfactory rate, as determined by visual observation through a sight glass, the rolling mechanism is activated, drawing the plastic sheet through the zone of vaporization at a constant speed. Then the metal shield is withdrawn, permitting the metallic vapor to reach the sheet, where it condenses. The thickness of the film of condensed metal is controlled by varying the speed with which the material is rolled. That may be set at any speed between 15 and 100 ft. per minute. Normal operating speeds usually range from 40 to 60 ft. per minute.

The length of the sheet that can be accommodated in one operation depends primarily on the thickness of the material. Standard-length rolls of 0.0075-in. acetate, which is about the heaviest gage used for this application, are 1500 ft. long and are readily accommodated in the units. Obviously, rolls of thinner material may be longer.

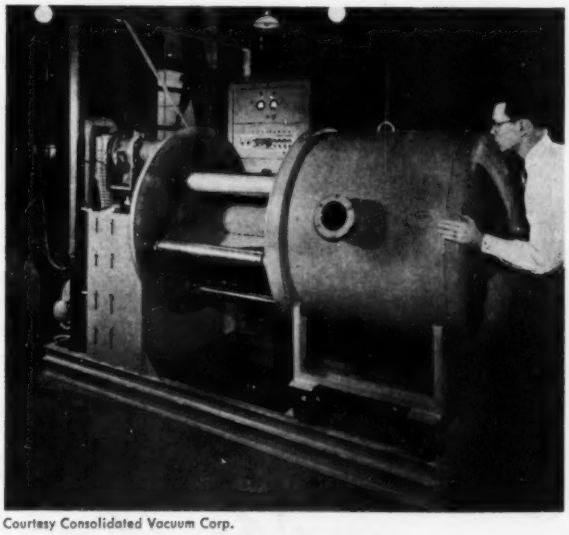
The high reactivity of molten aluminum, even under high vacuum, causes rather rapid formation of aluminum carbide in the graphite crucibles, and this usually makes it

(*Continued on p. 210*)



Courtesy Consolidated Vacuum Corp.

Roll coater accommodates web of plastic 26 in. wide, 1000 to 3000 ft. long, depending on sheet gage; speed of material determines thickness of coating



Plastic web is rolled back and forth in degassing unit — under ½-millionth atmospheric pressure — until no volatiles remain

Courtesy Consolidated Vacuum Corp.

Courtesy Minnesota Mining & Mfg. Co.

Decorative ribbon is made from vacuum-metallized acetate filaments

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Marblette Resin # 400. Wood coating resin—hardest known to man!—resistant to chemicals, solvents, and temperature extremes. Sets at room temperature. Dries to touch in 45 minutes; dries hard within six hours. Excellent dimentional stability. Recommended for industrial wood surfaces, foundry patterns, shoe lasts, hat blocks, etc.

51

Marblette Resin # 51. For bonding plastics to plastics, plastics to wood, plastics to fabrics, wood to wood, etc. Mixed with hardener, sets at room temperature overnight. Transparent or opaque.

71

Marblette Resin # 71. Dimensionally stable, quick curing heat set resin with 12 hour pot life and 4 month shelf life. Used in making stretch dies, tools, drill jigs, assembly jigs, forming blocks, foundry parts and match plates. Low viscosity insures excellent detail. Craze resistant. Light fast. Ivory colored.

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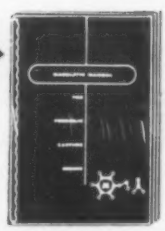

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Highly Filled Glass-Polyester Plastics

by R. F. Shannon† and L. P. Biefeld†

Reinforced plastics made with highly filled plastics slurries have excellent surfaces, improved physical properties, and reduced materials cost. The plastics binder can be extended with 70% inorganic filler by weight and still retain a pourable consistency. In general, the higher the filler concentration in the plastics slurry, up to 70% by weight, the higher the flexural strength and the lower the percentage absorption of water. Izod unnotched edgewise impact strengths are decreased only slightly by the use of additional filler.

The effect of inorganic fillers on the physical properties of reinforced plastics varies not only with the amount and type of filler used, but also with glass content. In general, the larger the amount of reinforcing glass used, the greater the effect of the highly filled plastics slurries. Flexural and Izod unnotched edgewise impact strengths averaging 24,000 p.s.i. and 15 ft.-lb., respectively, can be obtained in laminates reinforced with only 11% fibrous glass by volume and containing a 70% filler-30% plastic matrix.

Slight changes in processing procedures are necessary if both flat and formed shapes are to be successfully molded from highly filled plastics slurries. However, in no case is special mixing or molding equipment necessary.

Extending a plastics slurry with 70% inorganic filler results in a materials cost saving of about 50% on a weight basis or 35% on a volume basis. When correlated with physical properties, the materials cost per unit flexural strength is reduced approximately 50 percent.

HEAT convertible, unsaturated polyester plastics reinforced with fibrous glass are being used more and more in commercial applications (1, 4, 7, 8, 9).[1] These combinations of fibrous glass, inorganic filler, and plastics are tough, lightweight, high strength materials having excellent weathering resistance and dimensional stability superior to most metals (6, 7, 11).

A large variety of inorganic fillers is used in reinforced plastics. The three major advantages that can be gained through the use of these fillers are improved surface finish, higher physical properties, and reduced materials cost. The present practice is to incorporate up to 40% of filler in the plastic. It is commonly believed that higher concentrations of filler cause difficulties in processing and reduction in product properties.

An investigation was carried out to determine the effects of high filler concentration on product properties. A typical laminating polyester plastic, a few representative inorganic fillers, and widely used fibrous glass reinforcing media were evaluated.

The typical laminating resin chosen was a styrene-polyester copolymer designated Selectron 5003. The catalyst used was benzoyl peroxide compounded with tricresylphosphate (Luperco ATC).

The representative inorganic fillers used are listed in Table I. The table also includes the chemical composition, specific gravity, average particle size, trade name, and supplier of each.

Two forms of fibrous glass reinforcing media were employed. Flat laminates were reinforced with several plies of ¾-oz. polyester-bonded, chopped strand mat, which is designated as: Fiberglas Plastics-Reinforcing Mat, Treatment 12. Formed moldings were reinforced with preforms made from Fiberglas Plastics-Reinforcing Roving cut into 2-in. lengths and bonded with a polyester plastic.

Mixing Procedures

Three types of mixing action were used for introducing inorganic fillers into the plastic; namely, kneading, beating, and masticating. The kneading action of a dough mixer gave the best results as indicated by mirror-

Table I—Physical Characteristics of Inorganic Fillers

Filler	*Supplier*	*Composition*	*Specific gravity*	*Particle size, average*
China clay (Ideal Clay #2)	Witco Chemical Co.	$Al_2(SiO_3)_3$	2.6	2 to 5 micron
Kalite	Diamond Alkali Co.	$CaCO_3$	2.65	1 micron
Nonferal	Diamond Alkali Co.	$CaCO_3$	2.65	5 to 10 micron
Surfex	Diamond Alkali Co.	$CaCO_3$	2.65	5 to 10 micron
Suspenso	Diamond Alkali Co.	$CaCO_3$	2.65	5 to 10 micron
Calcium Sulfate anhydrite	General Chemical Div. (Allied Chemical & Dye Corp.)	$CaSO_4$	2.96	2 micron
Industrial White Hydrocal	U. S. Gypsum Co.	$CaSO_4 \cdot \frac{1}{2} H_2O$	2.6	82% < 325 mesh
Portland Cement	Columbia Cement Div. (Pittsburgh Plate Glass Corp.)	—	2.9 to 3.2	1600+cm.²/ g.[a]
White Portland cement	Universal Atlas Cement Co.	—	2.9 to 3.2	1600+cm.²/ g.[a]

[a] Surface area

* Reg. U. S. Pat. Off.
† Owens-Corning Fiberglas Corp.
[1] Numbers in parentheses link to references at end of article.

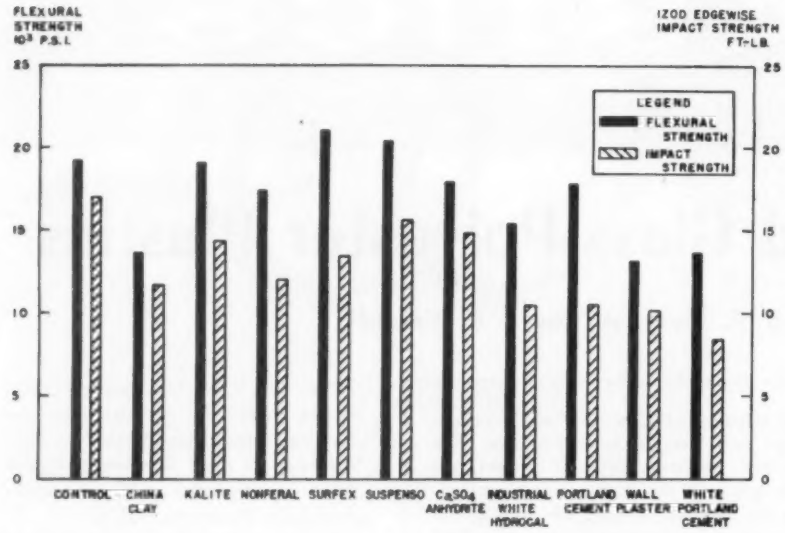


Fig. 1—Flexural strength and impact strength properties of reinforced plastics containing 11% glass by volume, and a plastic matrix consisting of 60% filler by weight

like surfaces and lack of filler separation in laminates containing slurries prepared in this type of mixer. The propeller-driven mixer proved unsatisfactory since it tends to beat an excessive amount of air into the slurry. Masticating action is the best for dispersing filler in plastic; however, laminates containing slurries prepared in this type mixer showed considerable filler separation.

The first step in the preparation of a filled plastics slurry is to catalyze the plastic. Two percent of Luperco ATC based upon the weight of the plastic was used in the preparation of the laminates. A propeller-driven mixer can be used to mix the catalyst into the plastic, the only precaution being not to stir so rapidly that air bubbles are introduced into the mix.

After the catalyst is thoroughly mixed in the plastic, a definite amount of the catalyzed plastic is weighed out and placed in a dough mixer. A predetermined amount of filler is added slowly with agitation to the catalyzed plastic contained in the mixing bowl. This is then followed by a short mixing period of about 4 or 5 minutes. Although a filled, catalyzed plastic slurry can be stored for several days at a temperature of approximately 38° F., it is recommended that it be used as soon after mixing as possible.

The mixing procedure as outlined above was used in the preparation of all of the flat test laminates. However, minor changes had to be made in the procedure when highly filled slurries were evaluated on large production molds. The catalyst content in the plastic had to be reduced to 1% in order to increase gel time and to obtain sufficient plastic flow. The mixing time in the dough mixer had to be extended to 30 min. if mirror-like surfaces were to be obtained.

Depending upon the type and amount of filler used, the viscosity of the filled plastic varies from thin, pourable slurries to thick pastes. For instance, a plastics slurry containing 70% Surfex by weight has a pourable consistency, whereas a mix containing 70% China clay by weight has a putty-like consistency.

A very simple test has been developed to determine whether a plastics slurry can be extended with 60 or 70% of a preferred filler and still retain a pourable consistency. A procedure similar to that for determining the oil absorption numbers of fillers is used, the only difference being that Selectron 5003 plastic is substituted for the oil (3).

Table II shows the plastic absorption numbers of a group of inorganic fillers. A filler must have a plastic absorption number below 35 if a pourable slurry at a 70% concentration is to result. The formula for calculating plastic absorption numbers (P.A.N.) is as follows:

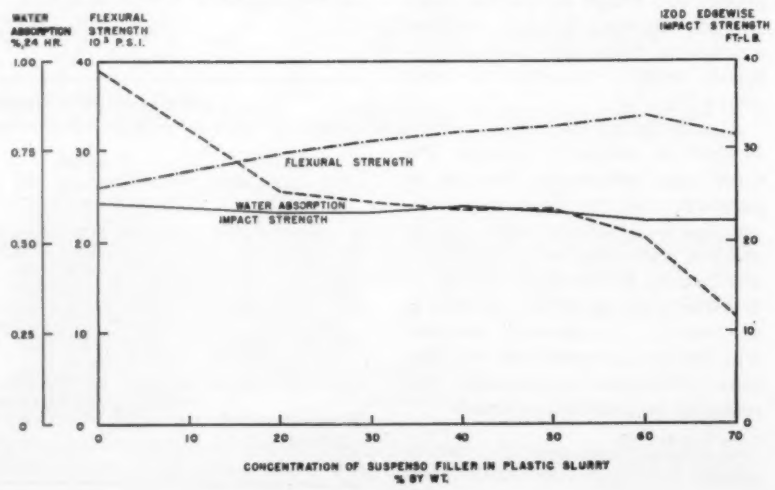
$$\text{P.A.N.} = \frac{\text{Vol. of plastic in ml.}}{\text{Wt. of sample in g.}} \times 100$$

China clay and Kalite have plastic

Table II—Plastic Absorption Numbers of a Selected Group of Inorganic Fillers

Name of Filler	*Plastic Absorption Number*
Calcium sulfate anhydrite	47
China clay	55
Industrial White Hydrocal	31
Kalite	54
Nonferal	47
Portland cement	30
Surfex	29
Suspenso	32
Wall plaster	35
White Portland cement	27

Fig. 2—Properties of Suspenso-filled laminates containing 22% fibrous glass by weight


WATER ABSORPTION %,24 HR.
FLEXURAL STRENGTH 10³ P.S.I.
IZOD EDGEWISE IMPACT STRENGTH FT-LB.
FLEXURAL STRENGTH
WATER ABSORPTION
IMPACT STRENGTH
CONCENTRATION OF SUSPENSO FILLER IN PLASTIC SLURRY % BY WT.

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- had a fender scraped in Philadelphia.
- was rammed while entering a driveway.
- overheated from a broken fan belt till the hood became too hot to touch.
- took roughly **2½ times the wear and tear** the average car is subjected to in that time—in the hands of at least 100 drivers!

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Vibrin-Fiberglas bodies for Kaiser-Darrin (Main Illustration) molded by Winner Mfg. Co., Trenton, N. J., Lunn Laminates, Huntington Sta., L. I., and Ashtabula, O., Molded Fiber Glass Body Co., Ashtabula, O.

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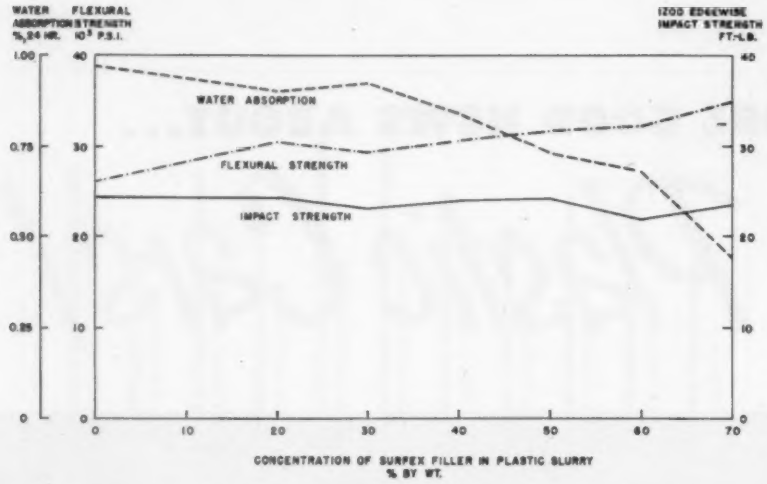

WATER ABSORPTION %, 24 HR.
FLEXURAL STRENGTH 10³ P.S.I.
IZOD EDGEWISE IMPACT STRENGTH FT.-LB.
WATER ABSORPTION
FLEXURAL STRENGTH
IMPACT STRENGTH
CONCENTRATION OF SURFEX FILLER IN PLASTIC SLURRY % BY WT.

Fig. 3—Properties of Surfex-filled laminates containing 22% fibrous glass by volume

absorption numbers around 55. Neither can be poured if more than 50% is used. Surfex and Suspenso fillers have plastic absorption numbers of 29 and 32, respectively. Plastics slurries extended with 70% of either of these two fillers are still very fluid and pourable.

Preparation of Samples

In the molding operation, the thick, filled, plastics slurry is forced to flow throughout the fibrous glass mat. The mat bonds in many cases lack sufficient strength to resist this flow without breaking. Thus, washing or flow of fibers occurs. Fiber washing can be eliminated, however, either by the use of less catalyst, which gives a longer gel time, or by the use of a stronger bond in the reinforcing medium.

In order to prevent washing in the test laminates, a thin layer of the filled, plastics slurry was spread out over each ply of mat used. Although this technique was not required for the thinner plastics slurries, it was adopted so that all of the laminates could be prepared in the same manner.

A lower catalyst content and a stronger bond in the reinforcing medium are necessary if fiber washing is to be prevented in production-size moldings. This was demonstrated by the use of a well-bonded preform and a thick plastics slurry containing only 1% catalyst. The slurry was poured onto the center of the preform and the mold closed as rapidly as possible down to the last inch of travel. The final speed of travel was just slow enough so that the mat bonds were not broken.

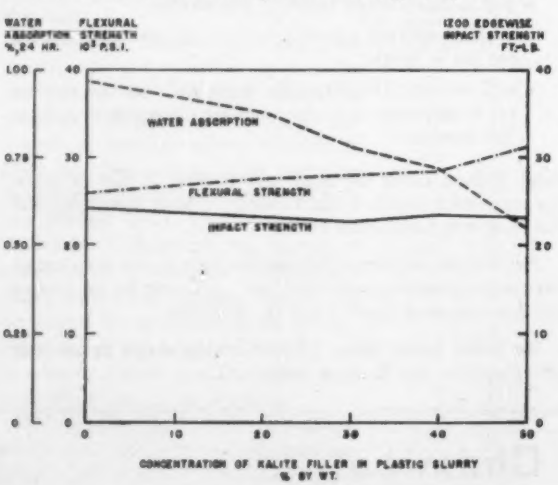
The uncured laminate was molded immediately after preparation so that any weakening of the fiber bonds of the reinforcing mat by the plastics mix was reduced to a minimum. The laminates were molded in a 10- by 10-in., semi-positive, matched metal mold in a steam heated hydraulic press. No pressure was used during the curing period since all laminates were molded to stops. A pressure of 440 p.s.i. was used to close the mold to stops. This pressure is necessary to overcome the resistance to flow offered by highly filled plastics and to remove most of the air bubbles present. The stops on the mold were set at ⅛ in. so that laminates 10 by 10 by ⅛ in. in size could be prepared.

Temperatures ranging from 240° to 260° F. and a time cycle of 6 min. were used to cure all of the laminates. Observations indicate that the time-temperature cycle can be reduced considerably. In fact, unless a very fast closing press is used, the sample will set up before the press is closed.

Test Procedures

The effects of inorganic fillers and glass concentrations were evaluated by measuring several physical properties of the carefully prepared laminates. Samples for evaluating each

Fig. 4—Flexural strength, impact strength, and water absorption of Kalite-filled laminates containing 22% fibrous glass by volume


WATER ABSORPTION %, 24 HR.
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FLEXURAL STRENGTH
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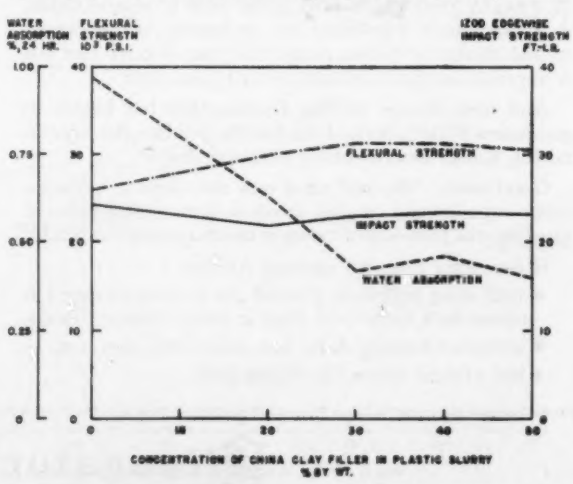
CONCENTRATION OF KALITE FILLER IN PLASTIC SLURRY % BY WT.

Fig. 5—Flexural strength, impact strength, and water absorption of China clay-filled laminates containing 22% fibrous glass by volume


WATER ABSORPTION %, 24 HR.
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WATER ABSORPTION
CONCENTRATION OF CHINA CLAY FILLER IN PLASTIC SLURRY % BY WT.

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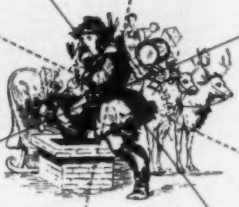

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filler and glass concentration were taken from three 10- by 10-in. laminates. A random sampling and testing procedure was employed.

The test methods used to measure physical properties were: 1) flexural strength, Method 1031; 2) water absorption, Method 7031; and 3) impact strength, Method 1071 (2). Two important modifications were made in the impact test method. The thickness of the sample was the thickness of the laminate, and the samples were not notched; thus the total width under impact was 0.5 inch.

Properties of Filled Materials

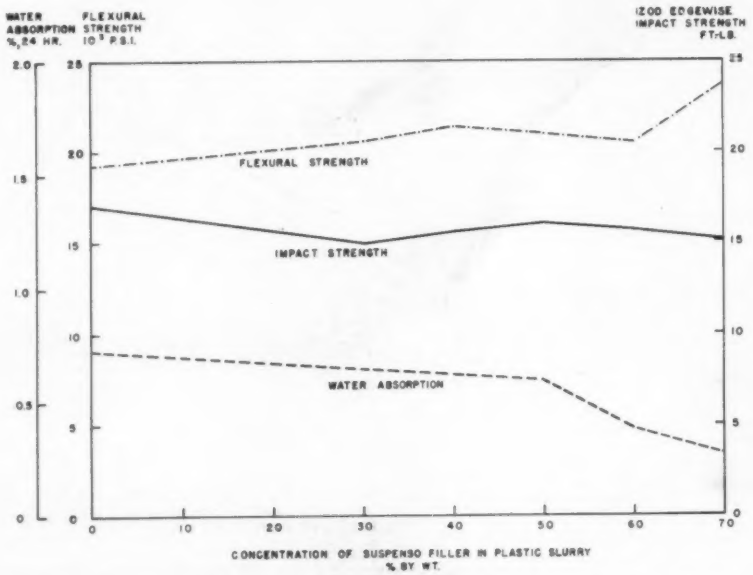
The initial study was directed toward determining: 1) whether the plastic could be extended to a 60% filler-40% plastics composition; 2) what effect this composition has on the physical properties of the reinforced plastics laminates; and 3) what range of physical properties can be expected from filled plastics reinforced with only 11% glass by volume.

Flat laminates containing each of the fillers listed in Table I were prepared. Each laminate contained 11% glass by volume and a matrix consisting of a plastics mix filled with 60% filler by weight. The physical properties of these laminates are shown in Fig. 1.* These data indicate that the substitution of a plastics mix containing 60% inorganic filler for an unfilled plastic often has little effect on the ultimate physical properties. In fact, the flexural strengths of several of the filled laminates tested were higher than the flexural strengths of unfilled laminates.

A comparison of these data with published data (5) on reinforced plastics containing high glass loadings indicates that physical properties are not directly proportional to glass content. Unfilled laminates containing 11% glass by volume give flexural strengths averaging 19,000 p.s.i. and Izod unnotched edgewise impact strengths averaging 17 foot-pounds. These results are far better than expected since an unfilled laminate containing 25% glass by volume yields a flexural strength of only 33,000 p.s.i. and an edgewise impact strength of 25 foot-pounds. Assuming that physical properties are directly proportional to glass concentration, a laminate containing 11% glass by volume should have a flexural strength of only 14,500 p.s.i. instead of 19,000 p.s.i. and an Izod unnotched edgewise impact strength of only 11 ft.-lb., instead of the 17 ft.-lb., actually obtained.

Since time would not permit a complete study of every filler listed in Table I, four of the most promising of those listed, from the standpoint of processing and properties, were chosen for further evaluation. They are Surfex, Suspenso, Kalite, and China clay fillers. Plastics slurries containing various percentages of each filler ranging from a low of 20% to the maximum amount that could be incorporated and still maintain a workable slurry were studied. These filled plastics slurries were reinforced with 11% and 22% glass by volume, respectively.

The effect on physical properties of reinforced plastics by each of the four fillers evaluated is shown in Figs. 2 through 9,* inclusive. No data are shown for China clay at matrix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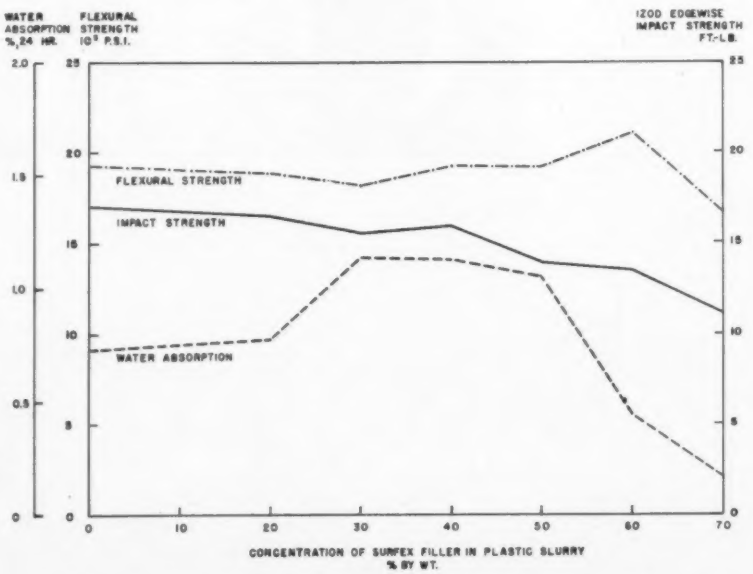
CONCENTRATION OF SUSPENSO FILLER IN PLASTIC SLURRY % BY WT.

Fig. 6—Properties of Suspenso-filled laminates containing 11% fibrous glass by volume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WATER ABSORPTION
CONCENTRATION OF SURFEX FILLER IN PLASTIC SLURRY % BY WT.

Fig. 7—Properties of Surfex-filled laminates containing 11% fibrous glass by volume

* Figures 1 and 2 appear on p. 126, Figs. 3, 4, and 5 on p. 128, Figs. 8 and 9 on p. 132.

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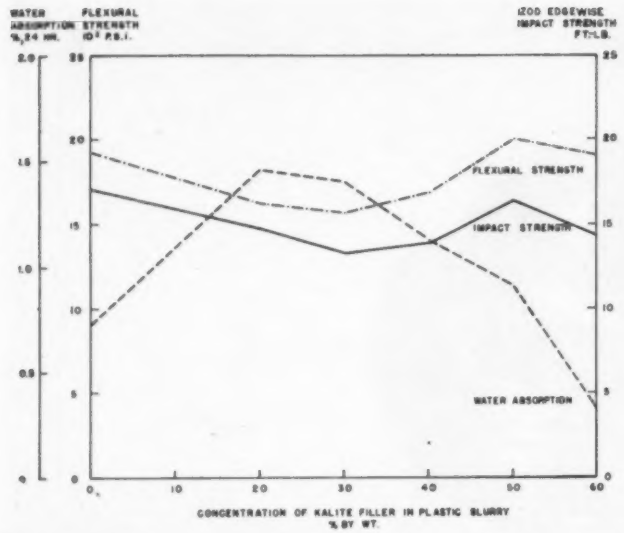
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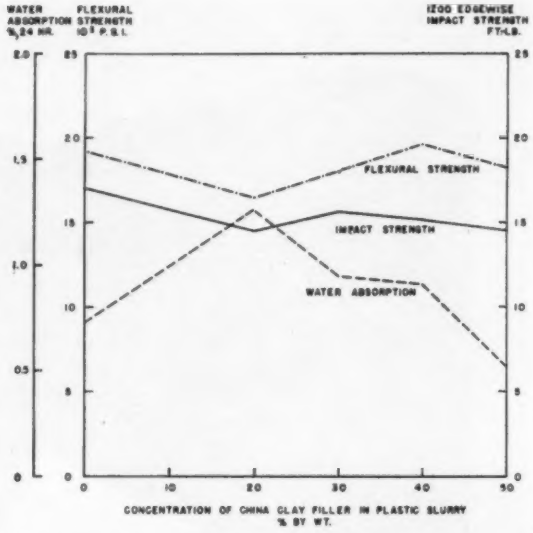
CONCENTRATION OF KALITE FILLER IN PLASTIC SLURRY % BY WT.

Fig. 8—Water absorption, flexural strength, and impact strength of Kalite-filled laminates containing 11% fibrous glass by volume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WATER ABSORPTION
CONCENTRATION OF CHINA CLAY FILLER IN PLASTIC SLURRY % BY WT.

Fig. 9—Water absorption, flexural strength, and impact strength of China clay-filled laminates containing 11% fibrous glass by volume

concentrations over 50% because the plastic mix is too thick to mold into a satisfactory laminate. Kalite filler acts like China clay, except that a 60% matrix concentration can be molded with 11% glass reinforcement.

The flexural strengths of laminates containing 11% glass by volume can be increased as much as 26% by the use of inorganic fillers. Figure 6 shows that by extending the plastic with 70% Suspenso, the flexural strength can be increased from 19,000 p.s.i. to 24,000 p.s.i.

The flexural strengths of laminates containing 22% glass by volume can be increased as much as 35% by the use of inorganic fillers. This is illustrated in Fig. 3 which shows that by extending the plastic with 70% Surfex, the flexural strength can be increased from 26,000 p.s.i. to 35,000 p.s.i.

Inorganic fillers decrease only slightly the Izod unnotched edgewise impact strengths. For instance, Fig. 6 shows that in laminates reinforced with 11% glass by volume, the substitution of a filled plastics slurry containing 70% Supenso for an unfilled plastic decreases the impact strength only 12%. In laminates reinforced with 22% glass by volume, the substitution of a filled plastics slurry containing 70% Suspenso for an unfilled plastic decreases the impact strength about 9% (Fig. 2).

The percentage of water absorbed by reinforced plastics laminates can be reduced as much as 70% by the use of fillers. Unfilled plastics laminates containing 11 and 22% glass by volume absorb 0.7 and 1% water, respectively, the first day. Figure 7 illustrates that by extending the plastic with 70% Surfex, the percentage of water absorbed by laminates containing 11% glass by volume can be reduced to 0.2 percent. Figure 2 shows that by extending the plastic with 70% Suspenso, the percentage of water absorbed by laminates containing 22% glass by volume can be reduced to 0.3 percent.

Glass Content

The effect of fillers on the physical properties of reinforced plastics varies not only with the amount and type of filler used, but also with the glass content. In general, the larger the amount of reinforcing glass used, the greater the effect of highly filled plastics slurries. The use of a plastics slurry containing 70% filler increases the flexural strength of laminates containing 11% glass by volume by not over 5,000 p.s.i., whereas it increases the flexural strength of laminates containing 22% glass by volume up to 9,000 p.s.i., as shown by a comparison of Figs. 6 and 3.

However, the 5,000 p.s.i. gain by laminates containing only 11% glass by volume raises the flexural strength to 24,000 p.s.i. This is only 2,000 p.s.i. lower than the flexural strength of an unfilled plastics laminate reinforced with twice that amount of glass.

Economic Aspects

The cost of most inorganic fillers is only a fraction of that of plastic, as well as that of fibrous glass. The substitution of highly filled plastics mixes for unfilled plastic will result in a considerable reduction in materials cost. This should encourage the introduction of reinforced plastics into markets not now being reached because of economic reasons (10).

At present, materials other than reinforced plastics are being used in these markets. By combining the economic advantages of low glass concentrations and highly filled plastics mixes, reinforced plastics can be made that will compete in these markets and do a better job at the same cost or an equal job at a lower cost than materials currently being used.

To show the savings in materials cost that can be effected by the substitution of a highly filled plastics mix for an unfilled plastic, a group of hypothetical prices were selected and materials cost per pound and per cubic inch of molded part were calculated.

The prices selected were in reality the average selling prices of these

(*Continued on p. 215*)

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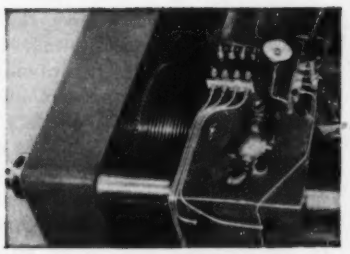

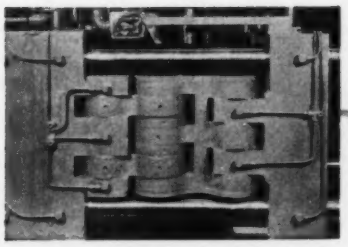

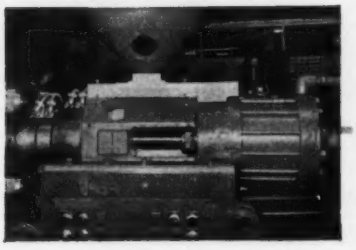

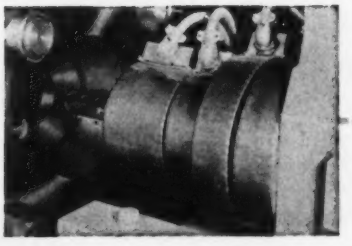

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Modified Phenol-Formaldehyde Resins

Modification by 1,2 Epoxides

by Thomas G. Harris,* Roderick H. Horning,* and Harvey A. Neville*

The modification of various intermediate phenol-formaldehyde condensation products (resols) by means of 1,2 epoxides is described. Epoxide addition occurs at the most highly ionized position on the molecule and is catalyzed by alkalies through the production of phenolate ions. The progressive conversion of phenol groups to ether linkages reduces the thermosetting properties of the resin and, with complete conversion, produces a stable product—a polyhydric alcohol. Esterification of these alcohols with organic acids results in a variety of products ranging in properties from plasticizers to materials which harden by air-drying or heat conversion.

THE ortho-para reactivity of phenol, exemplified by the condensation of phenol with formaldehyde, is enhanced by alkalies through increased ionization of the phenolic group, but is suppressed by the conversion of the phenol to an ether. Compounds such as methyl phenyl ether (anisole), 2-phenoxyethanol, and glycerol α, γ-diphenyl ether will not condense with formaldehyde, with sodium hydroxide as catalyst.

For probably similar reasons a phenol-formaldehyde condensation product at an intermediate stage will not undergo further condensation if the free phenolic groups are converted to ether linkages by interaction with a suitable reagent. By blocking all or only a predetermined portion of these phenolic groups the degree of "cure" upon further heating can be controlled.

The purpose of this article is to report the effects of 1,2 epoxides in modifying, by this means, the reactivity of various phenol-formaldehyde condensation products of the resol type.

The reaction of 1,2 epoxides with phenols has been investigated by others (1,2,3)[1]; products of this reaction have been examined as degreasers (4), solubilizers (5), mold preventives (6), stabilizers (7), detergent ingredients (8), anticorrosive agents (9), and fixing agents (10). The physical properties of these materials have also received some attention (11,12).

The reaction of 1,2 epoxides with phenol-formaldehyde resins of the novolac type has been studied by DeGroote (13), DeGroote and Keiser (14), and others (15,16).

Phenol-Formaldehyde System—Phenol and formalin solution (37%) are intimately mixed in a 1:2 weight ratio. This corresponds to a phenol to formaldehyde mol ratio of 1:2.32. Sodium hydroxide solution (25%) is added as the catalyst, the amount of sodium hydroxide thus introduced being 3% by weight of the phenol. This mix is heated to reflux and condensed at reflux to, or beyond, the point at which the free formaldehyde content approaches a constant value. The condensation is always interrupted before the viscosity begins to increase rapidly (Fig 1). Suitable viscosity measurements can be made by drawing a sample of the refluxing mix into a pipette and noting time of efflux.

A mol ratio of 1:2.32 has been employed except where otherwise noted. Compositions of lower mol ratios are prepared by replacing a portion of the formalin solution by an appropriate amount of water. Further experimentation under similar conditions indicates that:

1) The replacement of the formalin solution by a methanol-free formaldehyde solution causes a shift of the curves toward the left.

2) An increase in the amount of catalyst accelerates the reaction and results in products containing lower percentages of free formaldehyde. The additional catalyst does not decrease the time of reflux needed to reach gelation. Rather, it exerts a "solubilizing effect" and only by adjusting the pH and salt content to predetermined values can comparisons of different samples be made. When this is done (pH 6.5), it is ob-

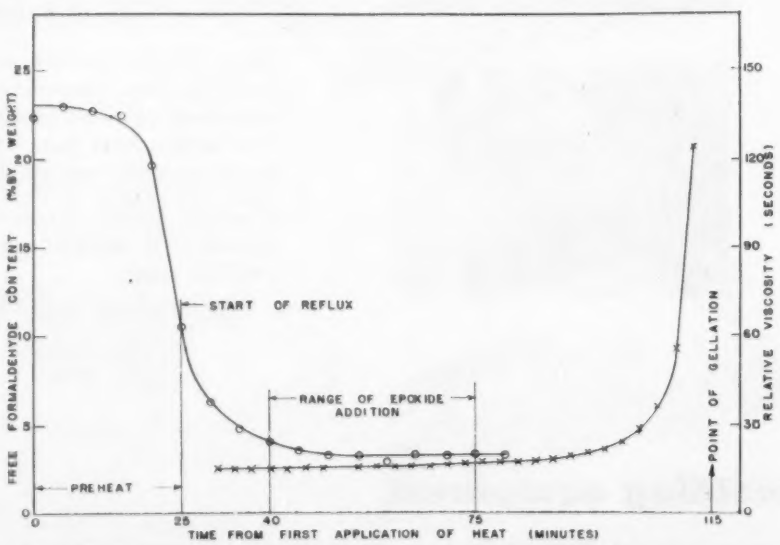

Fig. 1—Free formaldehyde and relative viscosity curves for phenol-formaldehyde system

* Dept. of Chemistry, Lehigh Univ., Bethlehem, Pa.
[1] Numbers in parentheses link to references at end of article.

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served that a precipitation point is reached more quickly, the higher the initial content of catalyst.

3) The constant value approached by the free formaldehyde curve is less, the lower the initial mol ratio of formaldehyde to phenol.

4) The amount of formaldehyde reacting per mol of phenol asymptotically approaches a value of 2.15 mols as the mol ratio of formaldehyde to phenol is increased above 2.32:1 (the catalyst being held constant at 3 percent).

5) The pH decreases only slightly as condensation proceeds. On the other hand, the omission of the phenol or its replacement by an ether, e.g., glycerol α,γ-diphenyl ether, will cause a considerable drop in pH (Cannizzaro reaction).

6) The formic acid content of the formaldehyde must meet certain specifications to assure concordant results. Excess formic acid is easily removed by an ion-exchange process.

Bisphenol-Formaldehyde System —A mix consisting of *p,p'*-dihydroxyl diphenyl propane 228.28 g., formalin solution 295.33 g., water 74.83 g., and sodium hydroxide solution (25%) 27.39 g., is heated to reflux and condensed at reflux for seven minutes. A clear, red-brown product forms which clouds upon cooling. The free formaldehyde content measures 3 to 4 percent.

Resorcinol-Formaldehyde Systems —A mix consisting of resorcinol 110.10 g., water 17.30 g., methanol 48.00 g., and sodium hydroxide solution (25%) 8.00 g. is heated to reflux. Formalin solution, 48.7 g., is added dropwise during the first 10 min. of reflux. Reflux is maintained for one hr., giving a clear ruby-red solution.

A methanol-free product is prepared by replacing the methanol and formalin solution of the above example by an equivalent amount of water and methanol-free formaldehyde solution. A clear, brown solution is formed.

These resins while not thermosetting become so upon the addition of paraformaldehyde. The addition is usually made just prior to application. Gel times are measured by mixing nine parts by weight of resin with one part of paraformaldehyde and observing the time needed to reach a state of non-flow.

The procedure employed for any particular epoxide is determined by its boiling point.

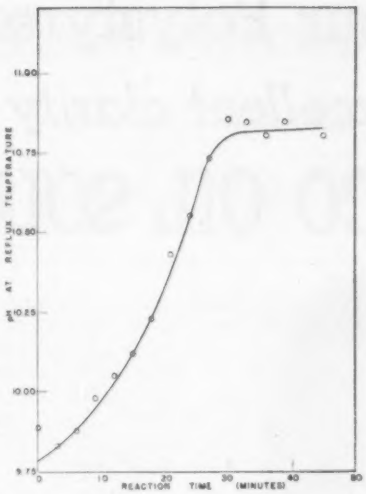


Fig. 2—Changes in pH with reflux for modified bisphenol-formaldehyde system

An epoxide which boils below room temperature (e.g., ethylene oxide) is liquefied and introduced into the previously cooled condensation product. The system is closed and reacted at a temperature above the boiling point of the epoxide until the pressure drops to atmospheric.

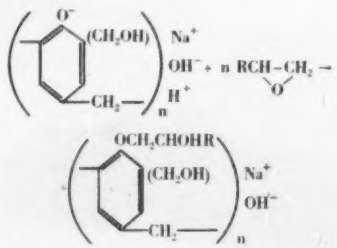
An epoxide which boils between room temperature and that of boiling water (e.g., propylene oxide) can be handled similarly, or the open system may be heated under a reflux condenser until the reflux temperature approaches that of the unmodified condensation product.

An epoxide which boils at a temperature above the boiling point of water (e.g., styrene oxide) is mixed with the condensation product and the whole heated at reflux with vigorous stirring until the pH becomes constant. Figure 2 is a typical pH curve obtained during the modification of the bisphenol-formaldehyde condensation product by glycidyl phenyl ether, the amount of the latter introduced being 2.4 mols per mol of the original bisphenol.

Mechanism of Reaction

The condensation products as prepared contain a considerable proportion of water. This water is not removed prior to modification since it aids in subsequent exotherm control and acts as ionization medium.

The epoxide attacks the condensation product at the most highly ionized positions, the phenolate ions. These are converted to ether linkages and more phenolate ions form:



The weakly acidic phenolic groups

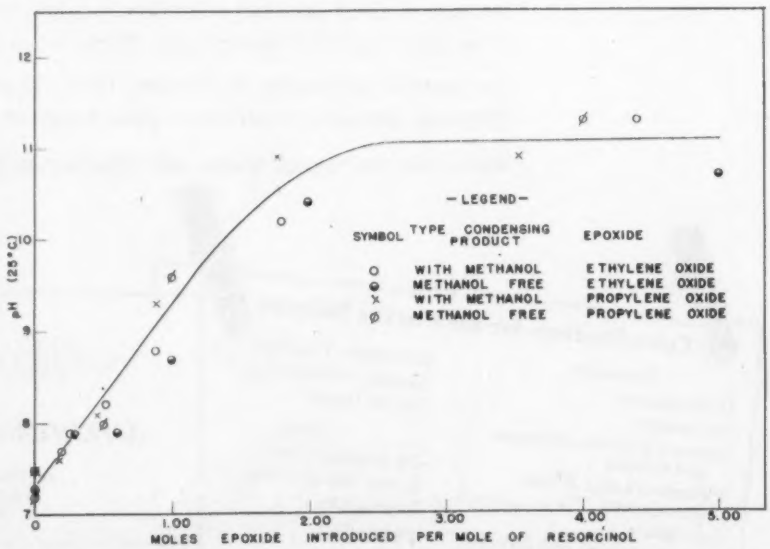

pH (25°C)
— LEGEND —
SYMBOL TYPE CONDENSING PRODUCT EPOXIDE
○ WITH METHANOL ETHYLENE OXIDE
● METHANOL FREE ETHYLENE OXIDE
× WITH METHANOL PROPYLENE OXIDE
ø METHANOL FREE PROPYLENE OXIDE
MOLES EPOXIDE INTRODUCED PER MOLE OF RESORCINOL

Fig. 3—Graph illustrating the effect brought about by an increase in epoxide modification on the levelling pH of resorcinol-formaldehyde systems

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gradually disappear as the reaction proceeds and the pH of the system increases. The pH rise continues until 1) no further epoxide remains or 2) phenolic groups are no longer present.

Determination of the time needed to reach constant pH can be accepted as an indication of complete reaction of the epoxide only so long as the amount of epoxide introduced does not exceed that necessary for complete conversion of the phenolic groups. The numerical value at which the pH attains constancy increases with increasing amounts of epoxide initially introduced until the above amount is reached; beyond this amount little further increase occurs in the leveling pH. This is shown by

Table I—Time to Constant pH in Modification of a Phenol-Formaldehyde (mol ratio 1:2.32) Condensation Product by Glycidyl Phenyl Ether

Glycidyl phenyl ether added per mol of phenol	*Time at reflux to reach a constant value of pH*	*Constant value of pH*
mol	*min.*	
0.4	15	8.7
0.8	45	9.2
1.2	100	10.8
1.8	57	11.0
2.4	60	11.5

Fig. 3, p. 138, a plot of final pH values of modified resorcinol-formaldehyde systems versus the mols of epoxide introduced per mol of resorcinol. These samples were prepared in pressure bottles, the bottles being rotated in a 45° C. bath for the times noted in Table III. The absence of pressure upon opening (at 45° C.) suggested complete reaction. This was later checked by vapor pressure measurements. Additional experiments have shown that:

1) Glycol formation is not an intermediate step of modification. The replacement of ethylene oxide by ethylene glycol does not produce similar pH effects.

2) Vigorous stirring is essential when a water-insoluble, high-boiling epoxide is used. Separation occurs at small amounts of modification making the reaction of the remainder of the epoxide more difficult.

3) The time of reaction to reach constant pH increases with increasing modification unless the amount of epoxide greatly exceeds that required for complete conversion of the phenolic groups. The excess epoxide accelerates the addition of the first mol (mass-action effect). This is illustrated in Table I for a system in which separation occurs.

4) The pH effects are masked by increases in catalyst concentration.

The mechanism by which the excess epoxide reacts has not been established. Miller, Bann, and Thrower (17) concluded from a study of the system phenol and ethylene oxide that structures of the type

were present. Such a system is not complicated by the presence of methylol groups, water, unreacted formaldehyde, and methanol.

When phenol-formaldehyde con-

(*Continued on p. 220*)

Table II—Rockwell Hardness of Casting of Phenol-Formaldehyde Resins Modified with Glycidyl Phenyl Ether

Glycidyl phenyl ether added per mol of phenol	*Reflux time*	*Yield of dehydrated resin per g. of phenol*	*Rockwell Hardness (H scale)*
mol	*min.*	*g.*	
	CURE: 4 DAYS AT 70° C.		
0.00	0	1.77	+50
0.25	5	2.14	+ 3
0.50	15	2.53	−83
0.75	40	2.93	Soft sol.
1.00	70	3.39	Visc. liq.
	CURE: 20 HR. AT 90° C.		
0.00	15	1.67	+77
0.10	15	1.89	+69
0.20	15	2.11	+58
0.30	15	2.21	+44
0.40	15	2.38	−16
0.50	15	2.57	−64

Table III—Gel Times of Epoxide Modified Resorcinol-Formaldehyde Condensation Products

Ethylene oxide[a] per mol of resorcinol	*Description of product[c]*	*Gel time*	*Propylene oxide[b] per mol of resorcinol*	*Description of product[c]*	*Gel time*
mol		*hr.*	*mol.*		*hr.*
		CONTAINING METHANOL			
0.00	Ruby red, M	5	0.00	Ruby red, M	5½
0.26	Ruby red, M	7	0.18	Ruby red, M	7½
0.53	Ruby red, M	9½	0.44	Ruby red, I	7½
0.88	Ruby red, I	9½	0.88	Red brown, I	11
1.80	Red brown, I	Gelled (2 mo.)	1.76	Red brown, I	Slight thickening (2 mo.)
4.40	Orange, M	No thickening (2 mo.)	3.52	Orange, I	No thickening (2 mo.)
		METHANOL-FREE			
0.00	Brown, M	5½	0.00	Brown, M	5
0.30	Brown, M	5½	0.20	Brown, M	5
0.60	Brown, I	7	0.50	Brown, I	5
1.00	Separated, I	—	1.00	Separated, I	—
2.00	Separated, I	—	2.00	Brown, I	Separates during test
5.00	Orange, M	No thickening (2 mo.)	4.00	Orange, I	No thickening (2 mo.)

[a]Reaction time in systems containing methanol was 2½ days at 45° C.; in methanol free systems 3½ days at 45° C.

[b]Reaction time in all systems was 18 hr. at 45° C.

[c]Miscibility of the product (1 part) with water (10 parts) is reported as M (miscible) or I (immiscible).

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

PLASTICS EQUIPMENT REFERENCE SHEET. R. B. Seymour and R. H. Steiner. Chem. Eng. Progress *49*, 52 (Jan.); 220 (Apr.); 276 (June); 276 (July 1953). The corrosion resistances of a typical carbon-filled phenolic cement at 70° and 250° F., a carbon-filled epoxy cement at 70° and 200° F., a plasticized vinyl chloride plastic sheet at 75° and 150° F., and a styrene-butadiene copolymer coating at 75° and 150° F. when subjected to various plant liquors and industrial chemicals are given in tabular form. General remarks on applications, chemical composition, workability, and mechanical and physical properties are included in these reports.

INDUSTRIAL PLASTICS. W. M. Bruner and P. J. Wayne. Chem. Eng. *60*, 193-204 (July 1953). The annual cost of corrosion in the country is estimated at $5.5 billion. The use of plastics in industrial piping and service conditions for a plant or production engineer are reviewed. Properties of various plastics materials are discussed and possible practical uses are suggested for each material. Comparative properties and industrial experience are guides to the intelligent selection of the correct material.

Materials

NEW VINYL-METAL SHEET. P. O'Keefe. Materials & Methods *38*, 94-5 (Sept. 1953). A process has been developed to bond rigid and semi-rigid vinyl film firmly to aluminum and steel sheets. The resulting laminate has the strength of the base metal and the corrosion resistance of the vinyl film. A big advantage over conventional coatings is the abrasion resistance. The laminate can be handled as a plain metal sheet in that it can be formed, deep drawn, curved 180°, and be crimped by a sheet metal worker. The vinyl film is superior to a sprayed vinyl film in several ways: Higher molecular weight resin can be used; large amounts of solvent are not needed; and costs are at least equal or lower. The price of the material is about ⅓ the price of stainless steel, but slightly more than galvanized steel.

NEW PLASTICS OF COMPOUNDS CONTAINING ACTIVATED METHYLENE GROUPS AND ALDEHYDES. H. Uelzmann. Kunststoffe *43*, 175-178 (May 1953). Compounds containing activated methylene groups were biscondensed with aldehydes to make linear or cross-linked high polymers from compounds containing several active methylene groups and aldehydes. Preliminary results of the catalytic reaction of acrolein, crotonaldehyde, and other aliphatic and aromatic aldehydes with compounds containing several acetate or cyano acetate groups yielded oily to hard products. The latter were suitable for casting with and without fillers. The mechanism of the reaction indicates a polyaddition. It is suggested to name this new group of high polymers "Almencon" resins.

DRY BLEND OR READY COMPOUNDED IMPACT POLYSTYRENE TO CONTROLLED QUALITY. Canadian Plastics *1953*, 62-63, (May-June 1953). A new "high impact concentrate" is described. By correct proportioning of the concentrate and the regular polystyrene, a high impact styrene of definite quality can be produced. A few of the advantages of the new technique are that 1) temperature control is not as critical, 2) time cycles are reduced, 3) lower pressure is used, and 4) dies used to mold cellulosic materials may be used.

FILTERABILITY OF CELLULOSE ACETATE SOLUTIONS. L. A. Cox and W. K. Mohney. Ind. Eng. Chem. *45*, 1798-1802 (Aug. 1953). A proved practical method for determining the filterability of high polymers in suitable solvents is presented, using cellulose acetate dissolved in acetone-water as the example. An interpretation of the results of constant rate filtration is covered. The effects of the principal filtration factors, such as temperature, rate, filter medium, and solvent composition are discussed. Practical applications of this method in studies relating to the manufacture of cellulose acetate are given. These applications may lend themselves to parallel studies with other high polymers.

Molding and Fabricating

SOME DESIGN CONSIDERATIONS FOR INJECTION MOLDING HEATING CHAMBERS. G. O. Gilmore and G. B. Thayer. Trans. A.S.M.E. *75*, 903-909 (July 1953). The design of injection molding heating chambers is discussed from the basis of heat-transfer and pressure loss considerations. Heat-transfer and pressure losses in the chamber are interrelated and the geometry of the passages through which the plastic moves can be arranged for optimum heat transfer rate and minimum pressure loss. The available theoretical, experimental, and practical information concerning the behavior of plastic materials under high pressures in granular and fluid conditions is considered. This information is combined into a systematic approach to the geometrical problems of heating chamber design.

PROCESSING OF RIGID POLYVINYL CHLORIDE PLASTIC. C. E. Parks. India Rubber World *128*, 631-34 (Aug. 1953). Processing techniques are discussed for high molecular weight rigid polyvinyl chloride resins. Suitable conditions and equipment are described for the following techniques: initial processing, including mill mixing, Banbury-mill mixing, post-Banbury milling, and granulating and cubing; extrusion; calendering; sheet laminating; and fabrication. The impossibility of molding rigid vinyl is discussed and the importance of temperature control as the most important single factor in processing this material is stressed.

Applications

WHERE PLASTICS ARE USED IN AIR LINERS. Materials & Methods *38*, 100-101 (Aug. 1953). Plastics wholly or partly comprise 340 separate items in a new air liner. Approximately 1000 lb. of plastics, 3.5% of the plane's weight, are used. Numerous examples of the use of various ther-

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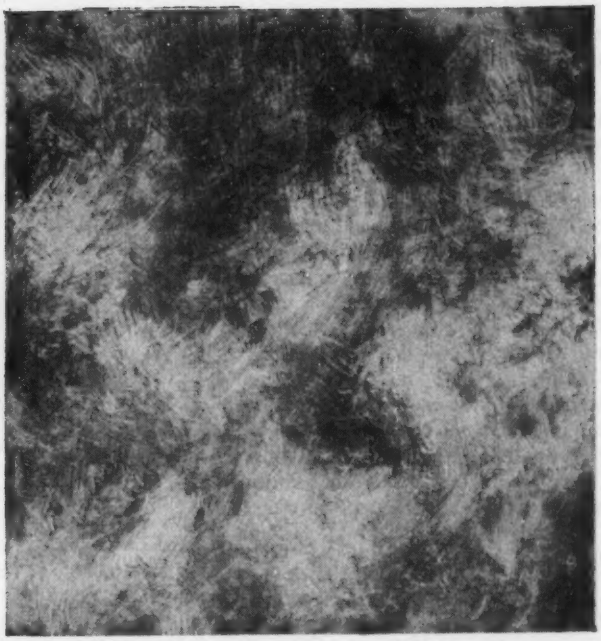

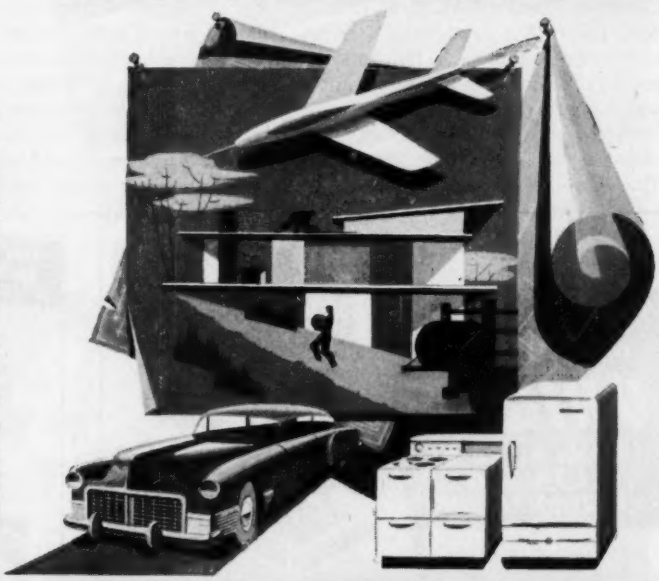

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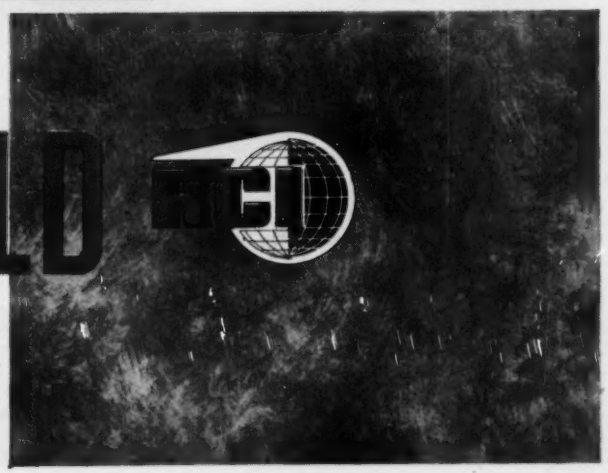

Synthetic Resins • Chemical Colors • Phenolic Plastics • Phenol
Glycerine • Phthalic Anhydride • Maleic Anhydride
Sodium Sulfate • Sodium Sulfite

moplastic and thermosetting materials are given.

IMPROVED FLUOROCARBON-INSULATED HOOKUP WIRE. M. Tenzer and J. Spergel. Elec. Manuf. *52*, 110-13 (Aug. 1953). The evaluation program used as a basis for the establishment of Military Specification MIL-W-12349 (SigC) "Wire, Hookup, Monochlorotrifluoroethylene, Insulated" is described. Tests discussed are those for determining the degree of degradation during extrusion, aging stability, heat shock, dielectric strength, low temperature flexibility, and miscellaneous properties such as flammability and abrasion resistance. The wire meeting this specification is suitable for continuous use from −40 to +135° C., and for short time use from −55 to +190° C.

POLYETHYLENE THIN FILM ACTS AS LINER-CORE FOR MULTI-WALL BAGS. Canadian Plastics *1953*, 79-80 (Mar.-Apr. 1953). A polyethylene film, in some cases as thin as 0.5 mil, is being put into service as a liner for multiwall kraft paper bags, where strength, moisture protection, and chemical resistance are important. The polyethylene is bonded to the inside of the kraft or in the middle of the plies, depending upon the application.

SELECTING PROTECTIVE COATING FOR METALS. J. B. Campbell. Materials & Methods *38*, 109-24 (Aug. 1953). All types of protective methods for metals, including organic coatings are considered. The types of coatings are discussed in a comprehensive manner. Particular applications such as water protection, chemical resistance, and soil protection are also considered.

Properties

ELECTRICAL PROPERTIES OF POLYSTYRENE. J. J. Millane. Brit. Plastics *26*, 220-24 (June 1953). The electrical properties of polystyrene are discussed under the headings of volume resistivity, surface resistivity, dielectric constant and power factor, and dielectric strength. A brief theoretical discussion of what each property is and how it is affected by moisture is given along with a comparison of the properties of polystyrene with those of other plastics and insulating materials. The influence of other physical properties such as heat distortion temperature, coefficient of thermal expansion, water absorption, and surface finish on the electrical properties are considered. The low vapor pressure of the material also makes it useful for practical microwave generators and other vacuum systems.

MEASUREMENT OF EXOTHERMS OF CASTING AND LAMINATING RESINS. H. G. Manfield. Brit. Plastics *26*, 230-31 (June 1953). A simple method is described to measure the exotherms of casting resins. A thermocouple is imbedded in a 1-in. cube of the resin and the temperature is recorded for the time of the cure. Several examples for various resins are given.

Testing

ELECTRON MICROSCOPY OF SYNTHETIC ELASTOMER LATICES. R. R. Stromberg, M. Swerdlow, and J. Mandel. J. Research Nat. Bur. Standards *50*, 299-309 (June 1953). The effects on the apparent particle size and its frequency distribution arising from the method of specimen preparation, shadowcasting, distortion of shape, and other artifacts inherent in the electron microscopy of synthetic elastomer latices are described. The

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possibility of applying a single, reproducible method of examination to four latices involving three copolymers (butadiene-styrene, butadiene-acrylonitrile, and butadiene-styrene-acrylonitrile) is statistically evaluated. These copolymers contain particles ranging in size from approximately 100 to 2100 A, and their average particle diameters are about 600, 800, and 1700 A, respectively.

A New Technique for The Mass Spectrometric Study of The Pyrolysis Products of Polystyrene. P. Bradt, V. H. Dibeler, and F. L. Mohler. J. Research Nat. Bur. Standards *50*, 201-2 (Apr. 1953). Polystyrene was placed in a small tube furnace and the degradation products evaporated directly into the ionization chamber of a mass spectrometer. At about 330° C. a fairly complicated mass spectrum was observed, extending to about mass 520. Major features of the spectrum are accounted for by a mixture of monomer, dimer, trimer, tetramer, and pentamer, with the first two by far the most abundant. The non-volatile liquid fraction recovered from pyrolysis of polystyrene when heated to 80° C. in the tube furnace gave a spectrum nearly identical to the above pyrolysis spectrum except that the styrene contribution is absent. The technique should be applicable to a wide range of polymers.

Identification of Complex Organic Materials. D. L. Harms. Anal. Chem. *25*, 1140-55 (Aug. 1953). A method for the characterization of polymeric materials by infra-red spectra of their pyrolysis products is presented. This method circumvents the serious limitation in the characterization of polymers by their infra-red spectra caused by the intractable physical state of many polymeric materials. A representative collection of spectra, indicating how comparisons are made, together with a synopsis of bands useful in identifying the original material, reveals the applications and limitations of the method. Several examples of the pyrolyzate-infra-red approach to typical problems are given to illustrate the unusual rapidity and utility of the procedure as compared to any other known method.

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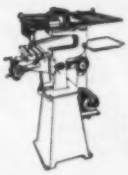

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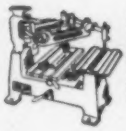

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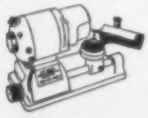

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QUERS. W. E. Shaefer and W. W. Becker. Anal. Chem. *25*, 1226-31 (Aug. 1953). A quantitative ferrous chloride reduction method was developed for measuring the nitrate nitrogen in cellulose nitrate. This was found to be directly applicable to the determination of cellulose nitrate in lacquers, including those containing alkyd resins, by assuming that lacquer-grade cellulose nitrate contains 12.0% nitrate nitrogen. Another ferrous chloride reduction procedure was applied to lacquers containing alkyd resins to effect the removal of the cellulose nitrate from them; and this made possible the determination of their combined phthalate content by a modified Kappelmeier method.

DETERMINATION OF MOLE RATIO OF UREA TO FORMALDEHYDE. Peter P. Grad and R. J. Dunn. Anal. Chem. *25*, 1211-14 (Aug. 1953). A new method for determining formaldehyde is applied to its quantitative recovery in urea-formaldehyde condensates. The complete depolymerization of urea-formaldehyde resins in all stages of condensation is attained and the amounts of urea and formaldehyde present are recovered and determined. The analysis for formaldehyde yields values precise to at least 3 parts per thousand. The determination for urea yields accurate results for all but fully cured resins.

IDENTIFICATION OF POLYMERIC MATERIALS. P. F. Kruse, Jr. and W. B. Wallace. Anal. Chem. *25*, 1156 (Aug. 1953). A method for the identification of polymeric materials by infrared analysis of their pyrolysis products is presented. This procedure has the advantages of 1) favoring close reproduction of spectra by pyrolyzing all samples at the same controlled conditions and 2) minimizing fogging of the cell windows by moisture present in the pyrolyzate.

A SIMPLE METHOD FOR OBSERVING THE MICROSCOPIC STRUCTURE OF CRYSTALLINE PLASTICS. H. A. Stuart and U. Veiel. Kunststoffe *43*, 179-80 (May 1953). By polishing or etching the surfaces of solid, opaque, and crystalline products, the microscopic structure becomes visible. Structural changes and inhomogeneities as a result of manufacturing or machining operations can be easily detected.

A NEW IMPACT TESTER FOR PACKAGING FILMS AND UPHOLSTERY MATERIALS. H. Klingelhöffer. Kunststoffe *43*, 181-84 (May 1953). A simple new impact tester for determining elongation during impact load as a function of time is described. The striking edge of the pendulum is provided with a recording pen, giving time-distance diagrams. The instrument is similar to the Beach Puncture Tester, described in A.S.T.M. Method of Test D 781-44T.

Chemistry

SOME REACTIONS OF POLYCHLOROTRIFLUOROETHYLENE. M. T. Gladstone. Ind. Eng. Chem. *45*, 1555-58 (July 1953). Polychlorotrifluoroethylene reacts at elevated temperatures (>200° C.) with hydrocarbons and other organic substances to yield hydrogen chloride with concomitant degradation of the polymer. Metals, metallic chlorides and oxides, and amines greatly increase this effect. In the absence of organic compounds, aluminum and nickel powders have little effect, but copper, except in vacuum, reacts extensively.

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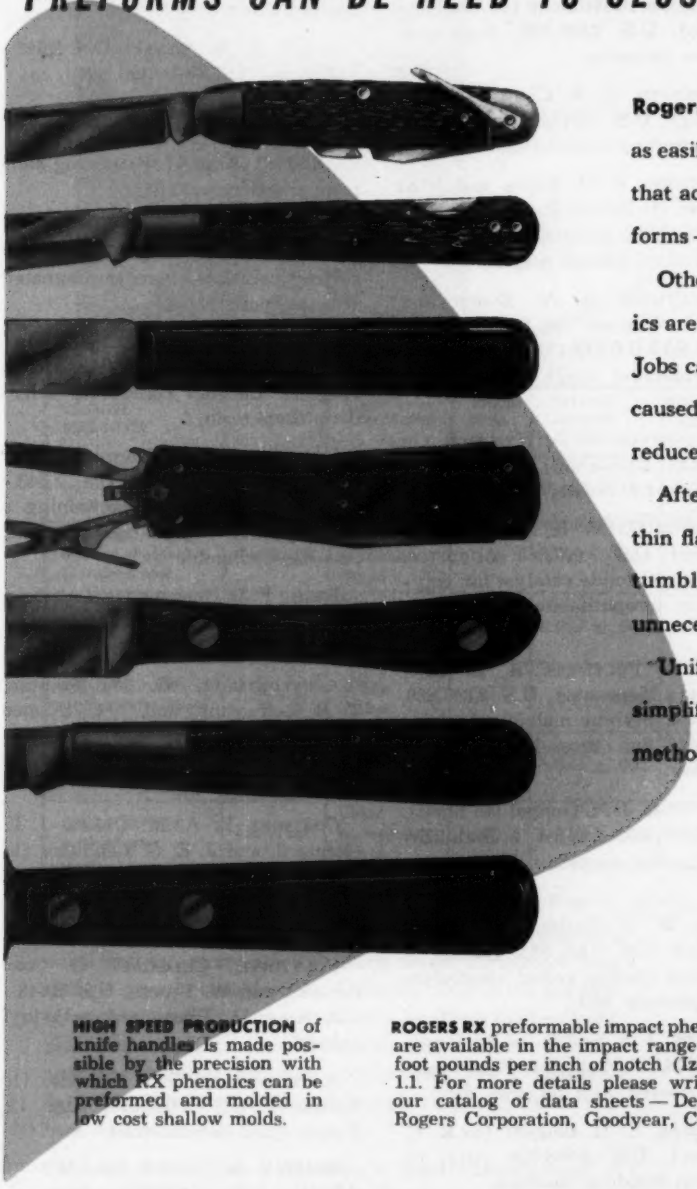

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

POLYMERS. D. J. Waters and D. L. Wilson (to Courtaulds). U.S. 2,647,-108, July 28. Polythioureas.

POLYMERIZATION. I. M. Kolthoff and A. I. Medalia (to Phillips Petroleum). U.S. 2,647,109, July 28. Emulsion polymerization in the presence of a reducing agent.

POLYMERS. P. A. Wiseman (to Firestone). U.S. 2,647,110, July 28. Polymers of 2,3-difluorobutadiene.

POLYMERIZATION. T. Shusman (to Monsanto). U.S. 2,647,111, July 28. Polymerization of styrene.

PRINTING PLATE. H. M. Richardson and W. Baumrucker, Jr. (to News Syndicate). U.S. 2,647,284, August 4. Curving a flat molded plastic printing plate.

INSULATION. H. J. Shive (to Bentley-Harris). U.S. 2,647,296, August 4. Tubular insulation with plastisol binder.

SHEET MATERIAL. M. P. Rehern. U.S. 2,647,440. August 4. Molecularly aligned plastic sheet.

TOY TRACK. R. N. Carver (to Louis Marx). U.S. 2,647,693, August 4. Molded plastic toy railroad track.

LETTERING FILM. D. J. Douglas, P. V. Palmquist, and J. D. Grove (to Minnesota Mining). U.S. 2,647,848, August 4. Strippable adhesively backed plastic lettering film.

GLASS MAT. R. E. Schwartz (to Vibradamp). U.S. 2,647,851, August 4. Resin-bonded resilient mat of glass fibers.

COPOLYMERS. E. M. Evans, S. E. Bradshaw and J. E. S. Whitney (to British Resin Products). U.S. 2,-647,876, August 4. Copolymers of vinyl phenols with drying oils.

RESIN. J. Dazzi (to Monsanto). U.S. 2,647,877, August 4. Polyvinyl chloride plasticized with benzothiazylmercaptoacetic acid ester.

POLYMERIZATION. M. M. Lee. U.S. 2,647,878, August 4. Method of promoting polymerization.

LACQUERS. S. Nitzsche (to Wacker-Chimie). U.S. 2,647,880, August 4. Silicone lacquers.

SILOXANES. H. A. Clark (to Dow Corning). U.S. 2,647,881, August 4. Thermosetting organosiloxane resins.

POLYMERS. E. M. Evans and J. E. Whitney (to British Resin Products). U.S. 2,647,882, August 4. Esterification of vinyl phenol polymers.

COPOLYMERS. E. M. Evans and J. E. S. Whitney (to British Resin Products). U.S. 2,647,883, August 4. Copolymers of vinyl phenols with butadiene.

ISOCYANATES. V. P. Wystrach (to American Cyanamid). U.S. 2,647,-884, August 4. Polyisocyanates.

POLYMERIZATION. H. R. Billica (to du Pont). U.S. 2 647,885. August 4. Antimony trioxide catalyst for polyethylene terephthalate polymerization.

STYRENE POLYMERS. R. B. Seymour (to Monsanto). U.S. 2,647,886, August 4. Styrene maleic anhydride polymers and cross-linking agent therefor.

POLYMERS. J. M. Goppel (to Shell). U.S. 2,647,887, August 4. Stabilization of sulfur dioxide rubbery polymers.

CELL. W. H. Taylor (to Sprague Electric). U.S. 2,647,938, August 4. Polyvinyl alcohol gelled electrolyte for a primary cell.

SCREEN. J. S. Smith (to du Pont). U.S. 2,648,013, August 4. Fluorescent screen coated with polymer film.

MOLDING. K. H. Baigent (to R. H. Windsor). U.S. 2,648,096, Aug. 11. Injection molding machine.

DECORATIVE SURFACE. M. F. Kritchever (to Traver). U.S. 2,648,097, Aug. 11. Securing decorative matter upon a polyethylene surface.

CANOPIES. R. W. Dunmire (to Goodyear Aircraft). U.S. 2,648,099, Aug. 11. Method of forming airplane canopies from plastic sheet.

ABRASIVE WHEEL. R. D. Mitchell, R. F. Pahl, and H. M. Hunter (to Carborundum). U.S. 2,648,177, Aug. 11. Resin-bonded abrasive wheel.

FORMING PLASTIC SHEET. W. I. Beach (to North American Aviation). U.S. 2,648,370, Aug. 11. Apparatus for postforming resin-bonded sheet.

SKI. E. W. Brabowski. U.S. 2,648,-543, Aug. 11. Laminated ski.

ACRYLONITRILE. G. W. Stanton and T. B. Lefferdink (to Dow). U.S. 2,648,592-3, Aug. 11. Removing salts from polyacrylonitrile.

LAMINATE. E. S. Hole. U.S. 2,648,-620, Aug. 11. Sticking together absorbent cellulose layers impregnated with phenolic resin.

LACQUER. H. S. Bloch (to Universal Oil Products). U.S. 2,648,640, Aug. 11. Lacquer containing a hydrocarbon resin.

COATING. J. E. Robison (to Fir-Tex Insulating Board). U.S. 2,648,-641, Aug. 11. Coating containing a carbohydrate, urea-formaldehyde, and dicyandiamide.

RESIN. F. R. Spencer (to American Cyanamid). U.S. 2,648,642, Aug. 11. Medium oil alkyd resin.

ACRYLONITRILE. G. W. Stanton, T. B. Lefferdink, and T. C. Spence (to Dow Chemical). U.S. 2,648,646-7-8-9, Aug. 11. Salt solutions of high acrylonitrile polymers.

COATINGS. L. A. M. Casati, J. L. Gonnard, and J. E. G. Lahousse (to Societe des Usines Chimiques Rhone-Poulenc). U.S. 2,648,651, Aug. 11 Polyvinyl chloride coatings.

POLYVINYL CHLORIDE. O. von Schickh and W. Froese. U.S. 2,648,-652, Aug. 11. Plasticized polyvinyl chloride.

ACRYLONITRILE. G. F. D'Alelio (to Koppers). U.S. 2,648,653, Aug. 11. Polymerized acrylonitrile.

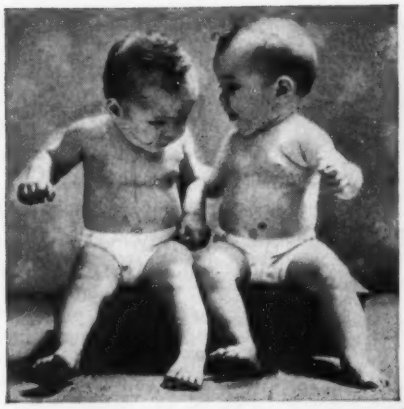
RESIN. J. E. Dereich (to Diamond Alkali). U.S. 2,648,654, Aug. 11. Resinous siloxane.

POLYMERIZATION. E. J. Vandenberg (to Hercules). U.S. 2,648,655-6-7-8 Aug. 11. Low-temperature emulsion polymerization.

PIGMENTED PLASTICS. V. C. Vesce

Low water extraction

is a job for CELLUFLEX* DOP



DESCRIPTIVE DATA

CELANESE PLASTICIZER	GRADE	APPEARANCE	COLOR APHA Max.	SPECIFIC GRAVITY @ 20/20°C.	ACIDITY	ESTER VALUE % Min.	PERMANGANATE TIME, Min. (In Minutes)	REFRACTIVE INDEX @ $n\frac{25°C.}{D}$
LINDOL* tricresyl phosphate coal tar base	Technical	Clear transparent liquid	75	1.165 ± .005	0.01 (2)	99	30	1.553
CELLUFLEX* 179C tricresyl phosphate petroleum base	Technical	Clear transparent liquid	150	1.165 ± .005	0.01 (2)	99	30	1.558
CELLUFLEX* DOP dioctyl phthalate	Technical	Clear transparent liquid	50	0.986 ± .002	0.01 (2)	98	—	1.485
CELLUFLEX* TPP triphenyl phosphate	Technical	White flakes	20 (4)	1.202 ± .005 (1)	0.003 (3)	99	30	1.550 (1)
CELLUFLEX* DBP dibutyl phthalate	Technical	Clear transparent liquid	50	1.045 ± .001	0.01 (2)	98	—	1.490
CELLUFLEX* 112 a mixed ester	Technical	Clear transparent liquid	40	1.210 ± .005	0.01 (2)	99	30	1.560

(1) @ 60° C. (2) % as phthalic, max. (3) % as phosphoric, max. (4) molten

In the production of plastic shower curtains, baby waterproof pants and the many other products where permanent flexibility is a major consideration, Celluflex* DOP is the specified plasticizer because of its resistance to leaching. DOP—dioctyl phthalate—has superior resistance to soap and water . . . demonstrates excellent light and heat stability, low temperature flexibility. It is highly compatible with vinyls, synthetic rubbers, and cellulosics.

Celanese today offers plasticizers to meet a broad range of applications. Celanese Technical Service and Application Laboratories are fully equipped to assist you in formulations and tests. Bulk stocks of Celanese* Plasticizers are maintained at centrally located distribution points for prompt delivery. Plastics manufacturers can take advantage of price differential and freight saving by ordering combination shipments of Celanese Plasticizers, Solvents and Intermediates — in compartmented tankcars, tankwagons, or mixed drum carloads.

Celanese Corporation of America
Chemical Division, Dept. 577-L
180 Madison Avenue, New York 16, N. Y.

Celanese* CHEMICALS

*Reg. U. S. Pat. Off.

(to B. F. Goodrich). U.S. 2,649,382, Aug. 18. Dispersions of plastics and pigments.

SUGAR PURIFICATION. J. C. Winters and R. Kunin (to Rohm and Haas). U.S. 2,649,390, Aug. 18. Purification of sugar with ion-exchange resins.

SEAL. J. M. Marshall (to Kraft Foods). U.S. 2,649,392, Aug. 18. Sealing thermoplastic packages.

BONDED STRUCTURE. R. K. Witt, W. G. Carson, and B. L. Raskin. U.S. 2,649,396, Aug. 18. Bonded structure of glass fibers and thermosetting resin.

POLYMER. M. Stacey and W. G. Overend (to Dextran). U.S. 2,649,-421, Aug. 18. Polysaccharide polymers.

RESINS. D. Aelony (to General Mills). U.S. 2,649,422. Aug. 18. Phenolic ester-formaldehyde resin.

RESINS. F. R. Spencer (to American Cyanamid). U.S. 2,649,423, Aug. 18. Short oil-modified alkyd resins.

COATINGS. B. G. Brand (to Battelle Development). U.S. 2,649,424, Aug. 18. China wood oil-terpene resins.

ADHESIVE. G. E. Hulse (to Hercules). U.S. 2,649,425, Aug. 18. Adhesive containing butadiene-styrene copolymer.

RESINS. H. Gilbert and F. F. Miller (to B. F. Goodrich). U.S. 2,649,426, Aug. 18. Solutions of vinylidene cyanide interpolymers in an organic nitrile.

POLYACRYLONITRILE. C. S. Marvel (to du Pont). U.S. 2,648,427, Aug. 18. Polymer of acrylonitrile dissolved in N,N-dimethylacetamide.

RESIN. H. Hönel and H. Manzano. U.S. 2,649,433, Aug. 18. Resol-alkyd resin product.

POLYMERIZATION. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). U.S. 2,649,434 Aug. 18. Polymerization of acrylonitrile in the presence of preformed polymers.

POLYMERIZATION. T. E. Stanin and J. B. Dickey (to Eastman Kodak). U.S. 2,649,435, Aug. 18. Polymerization of acrylonitrile in presence of formylated polyvinyl alcohol.

RESINS. L. H. Bock and L. J. Carlson (to Rayonier). U.S. 2,649,436, Aug. 18. Phenol ether resins.

INTERPOLYMERS. P. O. Tawney (to U. S. Rubber). U.S. 2,649,437, Aug. 18. Interpolymers of di-2-alkenyl citraconates or mesaconates and 2-alkenyl alcohols or chlorides.

COPOLYMERS. H. A. Bruson (to Industrial Rayon). U.S. 2,649,438, Aug. 18. Copolymers of acrylonitrile and basic acrylamides.

POLYMERS. H. P. Brown (to B. F. Goodrich). U.S. 2,649,439, Aug. 18. Condensable alkyl acrylate polymers.

MOLDING. T. J. Rhodes and J. J. Neville (to U. S. Rubber). U.S. 2,649,618, Aug. 25. Extrusion of plastics having plastic memory.

CASTING. W. A. Miller (to Carbide and Carbon). U.S. 2,649,620, Aug. 25. Casting expanded plastics.

MOLDING. E. P. Moslo. U.S. 2,649,-621, Aug. 25. Injection molding machine.

JOINT. F. P. Monaghan. U.S. 2,649,-806, Aug. 25. Molded plastic joint.

COPOLYMER. G. E. Ham (to Chemstrand). U.S. 2,650,151, Aug. 25. Copolymer of acrylonitrile and allyl glycidyl ether.

SUGAR PURIFICATION. H. W. Meijer (to N. V. Octroojen Maatschappij "Activit"). U.S. 2,650,177, Aug. 25. Purifying sugar with a resorcinol-*m*-phenylene diamine-formaldehyde resin.

ADHESIVE. D. D. M. Streed and J. M. Broadhurst (to U. S. Rubber). U.S. 2,650,181, Aug. 25. Styrene-isobutylene copolymer adhesive.

FABRIC COATING. L. P. Biefeld (to Owens-Corning Fiberglas). U.S. 2,650,184, Aug. 25. Coated glass cloth.

ADHESIVE. J. W. Larson and D. A. Tooley (to Consolidated Vultee). U.S. 2,650,185, Aug. 25. Bonding metal with a phenolic-polyamide adhesive.

RESIN-STARCH COMPOSITIONS. C. C. Kesler and E. T. Hjermstad (to Penick and Ford). U.S. 2,650,205, Aug. 25. Compositions of starch and alkaline-setting resins.

COPOLYMERS. J. B. Rust and W. B. Canfield (to Montclair Research and Ellis-Foster). U.S. 2,650,207, Aug. 25. Copolymers of vinylimides and unsaturated alkyd resins.

STABILIZERS. W. F. Arey, Jr. and R. E. Wood (to Standard Oil Development). U.S. 2,650,208, Aug. 25. Stabilizers for rubbers and plastics.

DRYING OILS. J. F. Nelson and A. H. Gleason (to Standard Oil Development). U.S. 2,650,209, Aug. 25. Composition of cyclopentadiene and an acylated copolymer of butadiene and styrene.

POLYMERS. J. N. Milne, D. Faulkner, and C. E. Hodis (to Distillers). U.S. 2,650,210, Aug. 25. Polymers of N-methylol paravinylbenzamide.

POLYESTERS. H. Dannenberg and J. R. Scheibli (to Shell Development). U.S. 2,650,211. Aug. 25. Polyesters of alkenyl succinic acids.

ADHESIVE. E. Windemuth (to Farbenfabriken Bayer). U.S. 2,650,212. Aug. 25. Diisocyanate-modified polyester.

POLYMERS. C. H. Hofrichter (to du Pont). U.S. 2,650,213. Aug. 25. Production of polyethylene terephthalate.

POLYMERS. R. N. MacDonald (to du Pont). U.S. 2,650,214, Aug. 25. Polymers of dl-methionine-N-carboanhydride.

POLYMERS. F. Strain (to Columbia-Southern Chemical). U.S. 2,650,215, Aug. 25. Copolymers of a polymerizable polybasic acid ester and a maleimide.

RUBBER HYDROCHLORIDE. G. Schuur (to Rubber-Stichting). U.S. 2,650,-389, Sept. 1. Process for making shaped articles of rubber hydrochloride.

COPOLYMERS. J. H. Sample (to Sherwin-Williams). U.S. 2,650,907, Sept. 1. Copolymers of styrene with a non-conjugated semi-drying oil.

PLASTICIZER. W. L. Beears (to B. F. Goodrich). U.S. 2,650,908, Sept. 1. Polyvinyl chloride plasticized with 3,5,5-trimethyl-1-hexanol-polybasic acid ester.

COATINGS. C. L. Betsch and F. H. Detrick. U.S. 2,650,909, Sept. 1. Methacrylate coatings.

CONDENSATES. F. Köhler (to Deutsche Gold- und Silber-Scheideanstalt vormals Roessler). U.S. 2,650,910, Sept. 1. Water-soluble urea-aldehyde resins.

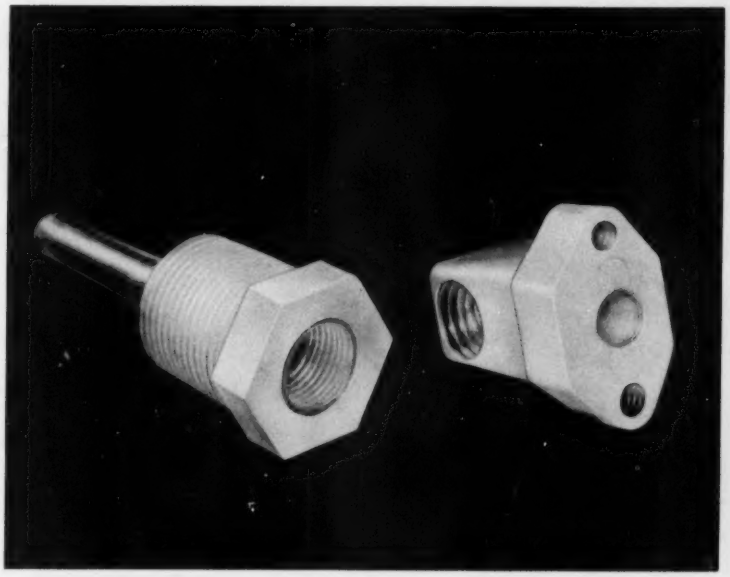
COPOLYMERS. H. Gilbert, F. F. Miller, and V. L. Folt (to B. F. Goodrich). U.S. 2,650,911, Sept. 1. Copolymers of vinylidene cyanide with alkenyl esters of monobasic acids.

DESIGN and PRODUCTION NEWS

FOR PLASTICS AND MATERIALS ENGINEERS

Published by TECHNICAL SERVICE, Chemical Manufacturing Division, The M. W. KELLOGG Company DECEMBER 1953

Unbreakable Miniature Test Jacks of Kel-F® Eliminate Leaks in 500 Volt RMS "HF" Circuits ...Block 8,000 Volt Current Surges



Small enough to permit mounting four to the square inch of panel area, these miniature jacks provide dependably insulated, damage-resistant test points on critical marine and aircraft electronic equipment. High insulation resistance and mechanical strength—with a minimum of bulk—are achieved by using "Kel-F" trifluorochloroethylene polymer as the insulation. The unique fluorocarbon plastic's non-wettability and zero water absorption provide protection against surface leakage and formation of conductive fungus.

Compact, hot assemblies, or where severe thermal cycling occurs, are ideal locations for the jacks because of the consistently high dielectric strength and constant of "Kel-F" over a wide temperature range (minus 320°F to plus 390°F). Dimensional stability of the insulation at high temperatures, and in contact with moisture, prevents softening or distortion, loosening or misalignment of vital contacts. High strength—impact, compressive, and flexural—of "Kel-F" precludes damage from vibration or rough handling.

Since "Kel-F" is chemically-inert, these jacks may be used successfully in equipment exposed to salt spray, oils, fuels and highly corrosive materials.

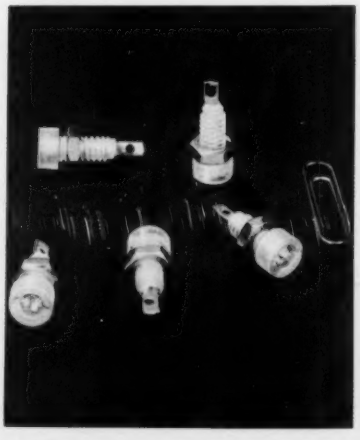
The Alden Products Company, electronic component manufacturer of Brockton, Mass., produces these "Mini-Test" point jacks. Injection molded from "Kel-F" trifluorochloroethylene polymer on special equipment designed by Alden, the jacks' mounting threads and contact slots are provided for during molding and require no finishing prior to use. The 360° spring contact of beryllium-copper is silver plated for corrosion resistance.

Refer to Report E-118

Tough, Precision Parts of Kel-F® Permit "Universal" Use of Analyzer for Corrosive, Hazardous Gases...Up to 170°F...Speed Calibration...Increase Accuracy

By providing gas sample inlet and outlet connections made of "Kel-F" trifluorochloroethylene polymer plastic, a *single* infrared analyzer can now be used to handle *all* process gas analyses.

The unusual chemical inertness of "Kel-F" permits corrosives such as SO_2 and reactive organics such as acetylene and halogenated hydrocarbons, to be sampled continuously and safely at temperatures up to 170°F.



In using this inert fluorocarbon, a source of adsorption has been eliminated, thereby speeding up the calibration procedure.

The precision molded plastic fittings remain leak-tight indefinitely, in spite of operational shock and vibration, because of the unusual strength—impact, compressive and flexural—of "Kel-F" over the maximum anticipated temperatures range. The resiliency of the plastic and its remarkable "memory" make pipe-thread connections leak-free without sealing compounds. They can also be readily disconnected without damage.

The Leeds & Northrup Company, Philadelphia, Pa. manufacturer of precision instruments and automatic controls, injection-molds two types of gas sample fittings from "Kel-F": One for a standard, non-hazardous installation (above, right), another for their "explosion-proof" analyzers (above, left). The excellent moldability of "Kel-F" polymer made it possible to obtain the precision threads, bores and mounting holes required for both types of analyzer fittings, using standard injection molding equipment.

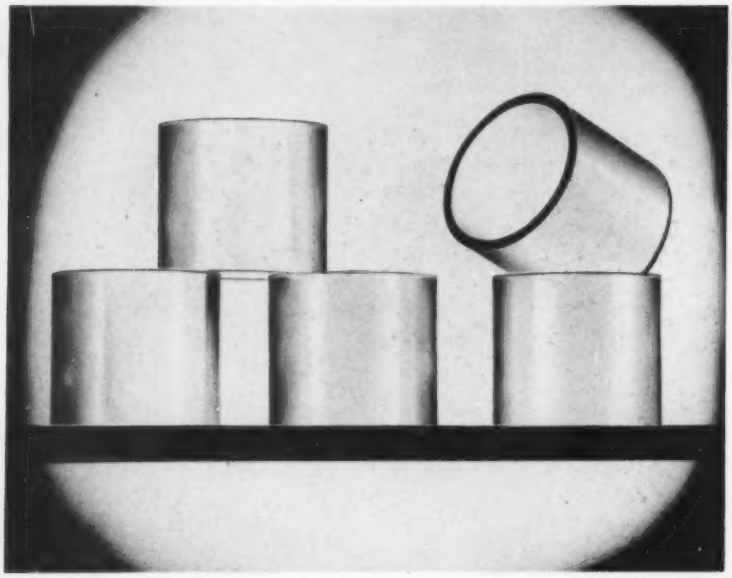
Refer to Report C-112

(SEE REVERSE SIDE)

® *Registered trademark for The M. W. Kellogg Company's trifluorochloroethylene polymer products.*

DESIGN and PRODUCTION NEWS

CONTINUED FROM PRECEDING PAGE



Non-Spalling Raschig Rings of Kel-F® Unaffected by Corrosive Radiation Products Up to 350°F... Reduce Tower Jamming...Boost Process Efficiency

Resistance to breakage or distortion under thermal cycling, inertness to highly-corrosive chemicals and radioactivity, are features of these Raschig rings designed for atomic energy studies. "Kel-F" trifluorochloroethylene polymer plastic was found to be the one chemically-inert substance tough enough to stand up under such severe operating conditions.

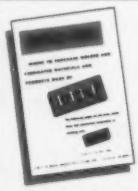
The fluorocarbon plastic tower packing remains unaffected even after continued exposure to corrosives such as hydrogen peroxide, hydrofluoric and fuming nitric acids and aqua regia at low and elevated temperatures.

The high strength—impact, compressive and flexural—of "Kel-F" over a wide temperature range (minus 320 to 390°F) prevents the rings from cracking or crushing at low temperatures and from spalling or distorting at high temperatures. The plastic's low thermal expansion permits accurate, compact tower packing without damage to tower or packing.

Preliminary studies indicate that "Kel-F" trifluorochloroethylene polymer retains its unique combination of properties after exposure to many levels of nuclear radiation.

The 1¼" diameter Raschig rings illustrated are one type produced by W. S. Shamban & Company, custom molders of Culver City, California. Injection-molded of "Kel-F" in multi-cavity molds on standard equipment, the packing needs no finishing prior to use. The Shamban Company also designs and molds other products of "Kel-F" for chemical and electrical applications. Among these may be included: gaskets, seals and "O" rings; rod, tube and sheet; and many types of electronic components.

Refer to Report C-111



New Quick-Reference "Buyers Guide" Off The Press...

Up-to-date, simplified handy directory enables you to locate instantly the nearest source of "Kel-F" polymer stock materials, finished products . . . dependable, experienced firms who offer extruding, molding and fabricating services. Get your copy from Technical Service.

® *Registered trademark for The M. W. Kellogg Company's trifluorochloroethylene polymer products.*

Molders & Fabricators of the Month

Leading molders, extruders and fabricators specialize in the production of materials and parts made of "Kel-F" . . . each month this column will spotlight several of these companies with their principal services and products.

American Durafilm Company
Newton Lower Falls, Mass.
Dispersion Coating

Carmer Industries
Elizabeth, N. J.
Extrusion
Machining
Tube

The Connecticut Hard Rubber Company
New Haven, Conn.
Compression Molding
Gaskets, Seals
Diaphragms

Gasco Fabricated Products
Akron, Ohio
Compression Molding
Gaskets, Seals

Hydro Molding Company
Plattsburg, N. Y.
Injection Molding
Coil Forms
Electronic Components

Plastics Manufacturing, Incorporated
Orange, N. J.
Injection Molding
Electrical & Electronic Components

For complete information regarding any item mentioned in DESIGN AND PRODUCTION NEWS, ask for detailed APPLICATION REPORTS, write

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Which millions buy more plastic products?

These 3¾-million families, screened for the BUY on their minds

OF ALL three biggest man-woman magazines, *only* Better Homes and Gardens *screens* its readers for their interest in what you have to sell.

Only BH&G grew big by showing better-off families how to make their living standards even higher—and what to buy to do it with.

Surveys show these families are buying plastic products by the millions—that they're ready to buy millions more. Dishes—glasses—curtains—plastic-upholstered furniture—toys—bowls—canisters. You name it. They buy it.

You get action from advertising in BH&G because BH&G readers have BUY on their minds and a greater ability to *do* the buying.

MEREDITH PUBLISHING COMPANY, Des Moines, Iowa

BH&G BUYOLOGICAL BRIEFS

Plastics Merchandising Program

The BH&G Plastics Merchandiser mails twice a year to nearly 400 plastic moulders, to inform them of the way BH&G is helping them sell their products—both editorially and advertising-wise. The Plastics Merchandiser offers information about special BH&G merchandising promotions which have incorporated plastics products as an important material in the lives of so many consumers. BH&G advertising and editorials help sell consumers on the value of plastic products for the home. BH&G's special in-store promotions help the retailer sell and merchandise these important plastic products to the consumer.

If you want your name added to this list please write R. J. Tiernan, Merchandising Manager, Meredith Publishing Company, Des Moines 3, Iowa.

PLASTIC MANUFACTURER ADVERTISERS IN BETTER HOMES & GARDENS
AUG.-DEC. 1952 & JAN.-JULY 1953

American Cyanamid Co.
Bakelite Co., Div. of Union Carbide & Carbon Corp.
Dow Chemical Co.
Du Pont de Nemours
Firestone Tire & Rubber Co.
General Electric Co.
B. F. Goodrich Co.
Goodyear Tire & Rubber Co.
Monsanto Chemical Co.
U. S. Rubber Co.
Westinghouse

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Timing Engineering," by Myrten G. Saake.

Published in 1953 by Ribble Engineering Co., 74-80 Montgomery St., Jersey City 2, N.J. 243 pages. Price $5.00.

With the growing automatization of industrial processes, the subject of timing control has assumed a role of ever-increasing importance. Heretofore it was considered simply as one subsidiary application of electrical control in general, but lately it has become a matter of primary concern to many engineers. The present volume, the first full length text dealing exclusively with industrial timers and their applications, has as its aim the systematic presentation of a general guide to the timing engineer, indicating to him what can be achieved with timing control and how to do it. The larger part of the work concerns itself with synchronous motor driven timers, discussing at length the various types available—adjustable repeating cycle timer, reversing duty repeating cycle timer, multiple circuit automatic reset timers, etc.—and outlining applications in which they are employed. It also contains a short section on pneumatic, electronic, and thermal timers.

"Latex in Industry," by Royce J. Noble, 2nd ed.

Published in 1953 by Palmerton Publishing Co., 250 W. 57th St., New York 19, N.Y. 912 pages. Price $15.00 (U.S.), $16.00 (all other countries).

Since the publication of the first edition of this work in 1936, many important advances have been made in the field of latex technology and applications, particularly in connection with developments in the area of synthetic latices and their specialized uses. The present study is a comprehensive investigation of the role being played by latices in industry today. The first part of the volume deals with sources of latex, its preservation and shipment, and offers a general account of the various raw materials necessary to the industrial applications of latex. In the second part, the author describes the various methods of employing these materials in the manufacture of end products. These methods include impregnation, spreading, dipping, molding, and electro-depositing. The third part concerns itself with test procedures. Copious references are included.

"Stewart's Scientific Dictionary," by Jeffrey R. Stewart, 4th ed.

Published in 1953 by Stewart Research Lab., "Forest Gate" at Franconia, Alexandria, Va., 788 pages. Price $10.50 (U.S.), $12.50 (all other countries).

While previous editions of this work specialized in defining terms used only in the protective and decorative coatings industry—paints, varnishes, lacquers, pigments, dry colors, vegetable oils, plasticizers, driers, wetting agents, etc.—the present version attempts to encompass all the terms used in the chemical process industries in general. In a strictly alphabetical listing, the volume presents definitions and descriptions of basic scientific terms, compounds, trade-named and proprietary chemicals, tests, instrumentation, and general chemical and physical properties. In many cases, the manufacturers of compounds and equipment are listed. Though not all-inclusive, the volume nevertheless presents a fairly exhaustive compilation of terms generally used in the chemical process industries.

"Index to ASTM Standards."

Published in 1953 by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 262 pages. No charge

This index is an adjunct to the "Book of ASTM Standards" and provides a reference for locating any ASTM standard in the bound volumes published by the Society. It is also of service in ascertaining whether a standard on any specific subject has been issued by the society. 1079 standards and 819 tentatives in effect as of December 1952 are covered. They are indexed under appropriate key words. The items under each subject are arranged alphabetically according to the significant word in the title. The index also contains a list of standards in continuous numeric sequence of ASTM serial designations. This list gives the complete title and publication reference of each standard.

"France-Plastiques"

Published in 1953 by Société de Éditions et Productions Publicitaires, 27, rue Lafitte, Paris IXe, France. 822 pages. Price 1650 F. (ca. $4.75) In French.

The 1953 (5th) edition of this yearbook presents a comprehensive picture of the plastics industry in France, covering material makers, equipment manufacturers, molders, and fabricators, as well as importers and distributors concerned with various phases of the plastics industry, all listed alphabetically under appropriate classifications. A list of trade names and brandmarks, manufacturing societies, educational institutions, and publications is included.

Electric heaters—Typical applications and operation characteristics of a line of automatic electric circulation heaters are depicted in Bulletin 701. These heaters are packaged units with built-in elements, heating chamber, thermostat, insulation, and mounting lugs, ready to attach to pipe lines leading to oil tanks, processing kettles, revolving rolls, and the like. Installation information is also given. *Edwin L. Wiegand Co., 7503 Thomas Blvd., Pittsburgh 8, Pa.*

Phenolic resins—An 80-page illustrated handbook covers in detail types, applications, and processing of phenolic casting resins. It describes properties and uses of nine resins, including accelerated, filled accelerated, colored, and non-accelerated types. Selection and preparation of molds are discussed at length, and machining, finishing, and fabricating techniques are outlined. A glossary of terms and definitions and a list of sources of supplies is appended. The manual is intended for technicians, engineers, designers, and chemists, as well as for non-technical executives and business men. *The Marblette Corp., 37-27 Thirtieth St., Long Island City 1, N.Y.*

Coatings—The advantages obtained through the use of vinyl, phenolic, and polystyrene latex coatings on

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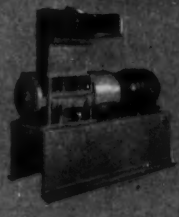

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concrete, stucco, cinder block, brick, plaster, and porcelain surfaces are reported in booklet VC. It is pointed out that these coatings resist weathering, most acids, alkalies, food stuffs, oils, and greases. It suggests a variety of applications and discusses the methods by which these coatings may be applied. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N.Y.*

Management—A catalog of literature published by the American Management Association during the past five years is presented in a 32-page booklet entitled "Progress in Scientific Management." Fields covered by the publications listed in the catalog are personnel, production, office management, marketing, finance, insurance, packaging, and general management. *American Management Association, 330 W. 42nd St., New York 36, N.Y.*

Instruments—Bulletin E-2 catalogs a line of industrial thermometers. Technical data, details of construction, temperature scale ranges, and various forms of mercury-in-glass industrial thermometers for installation in ducts, piping, and pressure vessels are listed. *Precision Thermometer and Instrument Co., 1434 Brandywine St., Philadelphia 30, Pa.*

Reinforced plastics panels—Color samples and installation ideas for corrugated, translucent, glass-reinforced polyester panels are presented in this 4-page folder. *Corrulux Div., Libbey-Owens-Ford Glass Co., P.O. Box 20026 Houston 25, Texas.*

Control valves—Bulletin 531 describes the company's line of air and hydraulic control valves, valve couplings, and high-pressure strainers. Sectional views of body, plunger, packing, and interior operation are presented, and sizes, actions, permissible pressures, and temperatures are listed. *C. B. Hunt & Son, Inc., Salem, Ohio.*

Silicone resins—Three preliminary data sheets provide information on the company's XR-543 and XR-544 silicone resins for foamed structures. Foams made of the resin have low density, are highly resistant to thermal shock, and may be produced by foaming-in-place. Data sheet 7-500 details typical properties of XR-543 resins, both in its solid and foamed state; data sheet 7-501 provides similar information for the XR-544 resin, which shows better retention of compressive strength at elevated temperatures; and data sheet 7-502 outlines procedures for making foamed structures from these resins. *Dow Corning Corp., Midland, Mich.*

Coaters—A line of tower coaters is described in Bulletin 1006. Applications include side coating, surface coating on non-permeable webs, and impregnation. Final design of each installation depends on requirements for each specific end product, and the bulletin describes and illustrates a number of such possible installation arrangements. *John Waldron Corp., P.O. Box 791, New Brunswick, N.J.*

Fat chemicals—Industrial chemicals derived from oils and fats are tabulated on a 17- by 27-in. wall chart. The chart lists the composition and specifications of seven adol fatty alcohols, 10 hydrofol glycerides, 14 hydrofol fatty acids, and nine sperm oil products. Also shown on the reference sheet are common uses for the chemicals, and a list of 21 sales offices. *Chemical Products Div., Archer-Daniels-Midland Co., 2191 W. 110th St., Cleveland 2, Ohio.*

Nylon-covered wire—Development, features, and applications of Wirelon —wire rope covered with nylon—are presented in this 16-page folder. Among the advantages claimed for the product are fatigue, wear, crush and corrosion resistance, and good thermal properties. A table of sizes and breaking strengths, as well as a listing of some of the outstanding properties, are included. *Rochester Ropes Inc., Culpeper, Va.*

Adhesive—Technical bulletin P-151 provides information—based on results of application field research conducted by the company—on the use of polyurethanes in the bonding of rigid materials (metal-to-metal, glass-to-glass, glass-to-metal, metal-to-plastics). Polyurethanes are products prepared from a polyfunctional hydroxyl compound with an excess of diisocyanates. The bulletin lists the various raw materials and chemical reactions involved in this adhesive system, as well as the principles to be followed in the preparation, curing, and use of isocyanate-based adhesives. Tables on tensile strengths of bonds, open cure conditions for high temperature bonds, and metal-to-metal bonding are included. In addition to adhesives information, the bulletin also discusses the use of polyurethanes as a surface coating for metals, as free film for dielectric use, and as a resin for potting compounds. *Monsanto Chemical Co., Phosphate Div., St. Louis 4, Mo.*

Ketones—Another in the series of the company's "family books" discusses the 14 ketones that it sells in commercial quantities. The discussion covers their uses in various industries, physical properties, specifications, shipping data, and constant boiling mixtures. A bibliography is included, giving the important references in chemical literature to these ketones. The book also lists four ketones that are available in research quantities and suggests uses for them. An important part of the publication is a section devoted to the specification test methods used by the company for its ketones. These laboratory control tests comprise some of the standard A.S.T.M. methods as well as new methods that have been specially developed by the company's own laboratories. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N.Y.*

Research progress report—An account of the major A.S.T.M. research activities is presented in "Review of A.S.T.M. Research," a 22-page pamphlet outlining the work done by the various research committees. Of particular interest will be the report of Committee D-20 on Plastics which concerns itself with strength properties, hardness, thermal properties, optical properties, permanence, analytical methods, and molds and molding. Other sections of the review, though not specifically slanted to plastics, deal with subjects indirectly related to them, such as corrosion testing of various metals, quantitative methods of determining degree of luster, methods of exposure testing, etc. *American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.*

Belt drives—Elements of V-belt drives are covered in this 52-page technical manual. The brochure discusses selection of V-belt and V-flat drives, and contains information on

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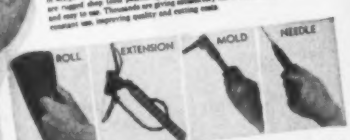

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how to select a V-belt drive as well as non-standard drive instructions, design data, etc. Tables, graphs, and charts are presented for each of the subjects treated. *Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass.*

Blasting—Information on deburring, die and mold polishing, blending grind lines, scale removal, honing of cutting tools, and pre-plating cleaning with both regular and high velocity wet blasting equipment is given in this 8-page booklet, "Pressure-Blast Wet Blasting." Each application is illustrated with a case history. *The Cro-Plate Co., Inc., 747 Windsor St., Hartford 5, Conn.*

Tanks—Bulletin 440 contains specifications for a line of processing tanks for the heating, melting, and dipping of plastics, waxes, and similar material. It also furnishes information on proper methods of heating strippable plastics coatings such as ethyl cellulose, cellulose acetate butyrate, etc. *Aeroil Products Co., Inc., Wesley St., S. Hackensack, N. J.*

Adhesive—Protein adhesives for the plastics laminating, woodworking, and prefabricated home industries are described in this 24-page booklet. Directions for using eight different formulations (casein, soybean, and casein-soybean blends), information on materials and equipment, and production tips are given. Details of a special gluing process are also included. *Monsanto Chemical Co., Plastics Div., Springfield, Mass.*

Colorant—Representative formulations and suggested uses for black dispersions in a variety of resins and plasticizers are listed in brochure L-2. Complete breakdown of the dispersion formula is given. Included also are two formulations of base blacks for the printing ink maker. *Acheson Dispersed Pigments Co., 2250 E. Ontario St., Philadelphia 34, Pa.*

Rigid sheet—Characteristics and applications of a styrene alloy rigid sheet are given in this 4-page folder (see MODERN PLASTICS, Oct. 1953, p. 111). The folder also provides specifications on sizes (width from 20 to 58 in., any length in ½-in. increments, gage from 0.005 to 0.125

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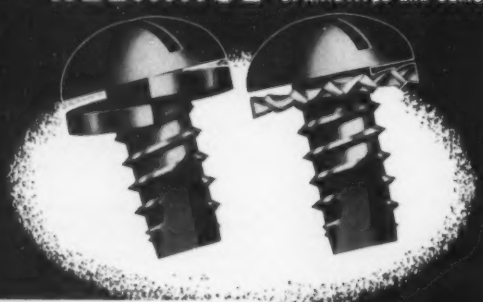

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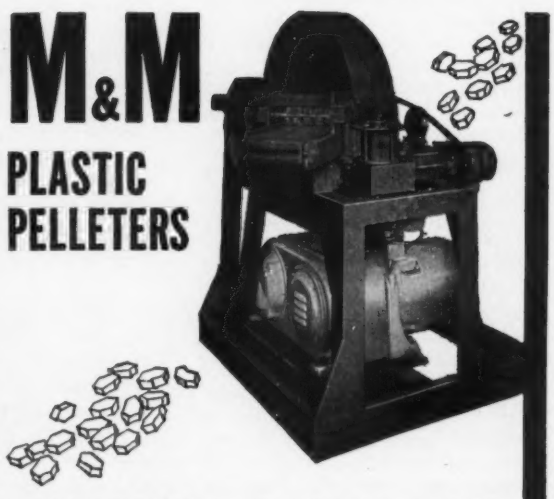

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inch), colors (unlimited range), chemical resistance, mold shrinkage and dimensional stability, finishing, painting, destaticizing, and weathering characteristics. Some of the applications are refrigerator door liners, mannequins, displays, etc. *Campco Div., Chicago Molded Products Corp., 2717 N. Normandy Ave., Chicago 15, Illinois.*

Electrical heating—Catalog 53 lists a complete line of electrical heating elements for use in molding, extruding, laminating, and other operations. These include rod heaters, pipe fitting water immersion heaters, pipe fitting oil and paraffin immersion heaters, flange type water immersion heaters, flange type urn heaters, finned heaters, and strip, ring, band, and cartridge heaters. The catalog also contains an application guide and various charts on specific heats of a variety of materials. *Heatube Corp., Allegan, Mich.*

Molding compound—Booklet M-1 offers data of interest to product designers and molders about five types of the company's phenolic molding compounds—general purpose, improved impact, heat resistant, low-loss electrical, and special purpose. A property table lists values for each of the five types when subjected to 24 mechanical, electrical, and miscellaneous tests. General steps in the production of molded products from these materials, design recommendations, and illustrations of typical products molded from these compounds are given. *Bakelite Co., Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Process control—Data book and catalog TC-10 presents the company's complete line of thermocouples, radiation detectors, and resistance bulbs. The 42-page book includes information on protection tubes, lead wire, and other accessories for use with indicating, controlling, and recording instruments. Various technical conversion tables are given. *Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.*

Plastics guide—Of prime interest to fabricators and end users of plastics, this manual and catalog contains a wealth of useful, up-to-date information on a line of plastics tubes,

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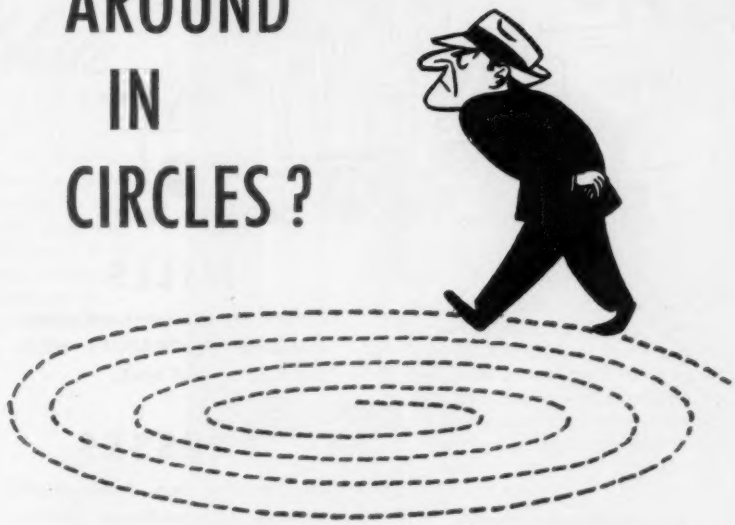

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rods, sheet, laminates, and stock products, and at the same time constitutes a basic guide for working in plastics, covering materials, equipment, and supplies. Some of the items presented are plastics sign letters, acetate sheeting, decorative laminates, styrene boxes, casting compounds, acrylic tanks, plastics glazing materials, wire coating, plastics cements, polishing and buffing accessories, polyethylene tubing and bottles, dyes for plastics, vinyl webbing, foamed plastics, and many others. Samples of some of the actual products are attached to catalog pages for greater clarity. Several sections deal with fabrication methods, going into considerable detail in outlining step-by-step procedures for working with various materials. One section is devoted to explaining the meaning of most physical property terms used in describing plastics. Price $1.00. *Fry Plastics Co., 7826 S. Vermont Ave., Los Angeles 44, Calif.*

Testing—A group of papers presented at the Symposium on Plastics Testing, organized by A.S.T.M. Committee D-20 on Plastics and held in June of this year, has been assembled in a 76-page A.S.T.M. Special Technical Publication No. 132. The topics covered are as follows: Measurement and significance of mechanical strength properties of plastics; measurement of effect of temperature on some physical properties of plastics; measurement of color, gloss, and haze; effect of molding conditions upon permanence of plastics; and residual stresses in phenolic plastics. Discussions are also included. Price $2.00, quantity prices on request to *American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.*

Product development—Services offered by this company in the initiation and execution of product research (both for complete programs and single projects), aimed at the development of a new, a better, or a cheaper item with wider market, are outlined in this 4-page bulletin. *Arthur D. Little, Inc., 30 Memorial Dr., Cambridge 42, Mass.*

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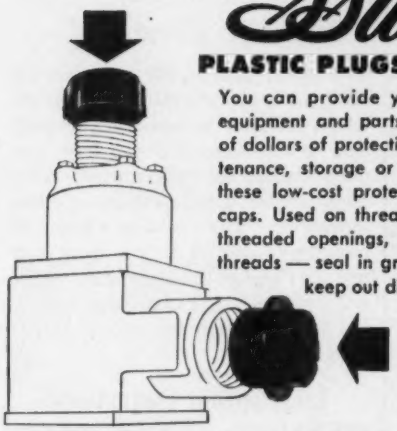

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EQUIPMENT DIVISION
Seventy Memorial Drive, Cambridge, Massachusetts

Good News!
LARGER SIZES
Polyethylene Sheets
Compression molded thermoplastic sheet stock now have available larger sizes of Acadia polyethylene. These are available in the new size of 36" x 36" x 1/8".
Standard sizes are furnished in 20" x 20" from 1/32" to 1" thick and 24" x 24" from 1/16" to 1/2" thick. Special sizes are also available. Polystyrene, Tenite, Saran, Vinylite, Geon, Ethyl-Cellulose and Styraloy sheets can be compression molded in most of the above sizes.
Write or write for specifications.
Acadia Synthetic Products Division
WESTERN FELT WORKS
4035-4117 Ogden Ave. • Chicago 23, Ill.

ACADIA
Processors of Synthetic Rubber and Plastics • Sheets Extrusions • Molded Parts
Synthetic PRODUCTS
MANUFACTURERS AND CUTTERS OF WOOL FELTS

TRANS-PAK, INC. NATIONAL TINSEL MANUFACTURING CORP. PRATT INSTITUTE
GLADWIN PLASTICS STANDARD PYROXOLOID CORP.
STEDFAST RUBBER CO. OF CANADA NOMA ELECTRIC CORP.
PENTAGON PLASTICS
ASSOCIATED ADVERTISING CELANESE CORP. PLASTIC INNOVATIONS, INC.
PLASTIC PRINTING CORP. STAR BAND CO., INC.
AMERICAN MERRI-LEI CORP. IDENTICAL FORMS, INC.
DEITZ MIRACLE LENS CO. EMPIRE CURTAIN COMPANY
DOW CHEMICAL CO. THE KAGE COMPANY
EINSON-FREEMAN CO. MAJESTIC CREATIONS
WHYTE MANUFACTURING CO. KAYE NOVELTY CO.
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ULLMAN CO. ORNAMENTAL LEATHER EMBOSSING WORKS AUBURN BUTTON WORKS
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LION LEATHER & PLASTICS

THE BEST FOR PROCESS HEAT
INRA
FOR VACUUM FORMING
INDUSTRIAL RADIANT HEAT CORPORATION

THIS SYMBOL
MEANS UNLIMITED*
PROFIT MAKING . . .

INRA
PLASTIFORMER

* Unlimited profits because your opportunity to manufacture an unlimited number of plastic items that have heretofore been too expensive or actually impossible to mold with certain machines. Using any thermoplastic sheet material THE INRA PLASTIFORMER opens up a new era of manufacture using the vacuum forming method either with male or female low cost molds, or by means of the DRAPE method of forming.

Write for details in folder

Industrial Radiant Heat Corp.
Box No. 123 GLADSTONE, NEW JERSEY

in catalog 265-A. Fourteen styles of the joint are listed, with sizes ranging from ¼ to 2 in., handling temperatures from −50 to 600° F., and pressures from vacuum to 600 p.s.i. (steam) or 3000 p.s.i. (hydraulic). *Barco Mfg. Co., 501 Hough St., Barrington, Ill.*

Vibrators—Catalog 109 describes the company's air vibration equipment, which includes both metallic-impact and air cushioned types. It finds application in chemical plants, foundry facilities, and a wide variety of other industries. The catalog lists 29 mountings and 14 piston sizes, and includes an engineering data sheet and price list. *The Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13, Ohio.*

Encyclopedia Corrections

DESPITE the great care taken by our editors in the assembly of the 943-page 1953 Modern Plastics Encyclopedia, a few errors crept in.

The following correction notes are called to our readers' attention:

In the Plastics Properties Chart, the United States Gasket Co., Camden, N. J. was not listed as a maker of fluorocarbon (polytetrafluoroethylene) sheet materials. The company manufactures Chemelec metal-faced Teflon sheet, Chemelec pure Teflon sheets, tape, rods, bars, and fabricated parts, and Chemiseal Teflon gaskets, packing, chemical resistant expansion joints and other auxiliaries.

And the following corrections are noted for The Directory Section:

A. Bamberger Corp., Brooklyn, N.Y. was inadvertently omitted from Reclaiming of Plastic Scrap on page 843.

Claude P. Bamberger, Inc., Brooklyn, N. Y. was omitted in the following classifications: Molding Compounds C, D, M, O, on page 807. Exporters and Importers on page 813. Raw Materials on page 814.

Claremould Plastics Co., Newark, N. J. injection molders, was unfortunately left out of the Molders Section on page 859.

Poly-Lite is a trade name for extruded panels made by Sandee Mfg. Co., Chicago, Ill.

J. G. Tilp Inc., erroneously listed on page 937 of the Directory as being located at Newark, N. J., are at Springfield and Milltown Rds., Union, N. J.

From Sleek Boat Hulls To Tubs For Automatic Washers

Pittsburgh Selectron POLYESTER RESINS

Now Ready For A Thousand New Uses

THE growing acceptance of Pittsburgh SELECTRON Resins for civilian and military production is not surprising. These remarkable reinforcing polyesters have enhanced appearance, improved utility and reduced manufacturing costs on a wide range of products from boat hulls to tubs for automatic washers.

● **The Winner Manufacturing Company,** of Trenton, N. J., uses SELECTRON in molding entire boat hulls. There are no seams or joints to open under vibration, shock or weather, or to require seasonal conditioning. The Apex Electrical Manufacturing Company, of Cleveland, Ohio, uses these resins to build two-piece baskets for its Wash-A-Matic that are lighter in weight, give better service and cost less than earlier 32-piece metal assemblies.

● **SELECTRON Resins** are thermo-setting polyesters which are available in consistency from a thin syrup to extremely high viscosity. They polymerize to form solids, with or without heat and with or without pressure.

● **When combined** with such fillers as Fiberglass, cotton, rayon, nylon, felt, sisal, paper, etc., SELECTRON Resins provide a new kind of material that is lighter than aluminum, yet—weight for weight—is stronger than steel. This material has great impact resistance and withstands the deteriorating influence of weather, sunlight, heat, abrasion and many chemicals. It can be molded in durable colors.

● **Parts in which** SELECTRON Resins are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fillers for casting, potting and impregnating.

● **More and more** manufacturers are turning to SELECTRON Resins to make their products better looking, stronger and more durable. Why not call on us for advisory service? We'll be glad to have one of our engineers discuss your problems with you without cost or obligation. Such a visit may point the way to important production economies and added sales appeal.

Send for FREE Booklet

Write, wire or phone today for our new booklet containing description of SELECTRON Polyester Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, SELECTRON Products Division, 7000 Gram Building, Pittsburgh 19, Pa.

Just a few products in which Pittsburgh SELECTRON Resins are now used—

Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
Machinery housing and guards
Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

PITTSBURGH Selectron

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

NEW MACHINERY AND EQUIPMENT

Vacuum Molding — Automatic deep drawing machine for forming rigid and soft thermoplastic sheet operates on cycles of only 8 to 14 sec. per 0.010-in. thickness to heat and form the sheet. Exact cycle time depends on composition of the sheet. Total available molding surface is 24 by 36 in., usable for either one single large mold or for several smaller ones which may be of various designs. Cycle speed applies to the entire molding surface.

The unit, manufactured by Hydro-Chemie Ltd., 21, Dreikönigstrasse, Zurich, Switzerland, has an effective heating surface of 24 by 36 in., with overlap for clamping and protection against effects of ambient heat. Heaters are designed to distribute heat uniformly over the entire molding area. Temperature is electronically controlled at any desired point between 200 and 750° F.

Each machine is provided with two mold plates to make continuous operation possible. Both plates are furnished with several vacuum and compressed air openings, plus numerous tappings so that one or more molds can be readily attached to each plate. The plates may be raised or lowered pneumatically to change distance between sheet and heat for further temperature control.

In addition to its vacuum pressure pump, the machine is equipped with manual air nozzles located alongside the mold plates to facilitate removal of intricate pieces, as well as for cleaning molds.

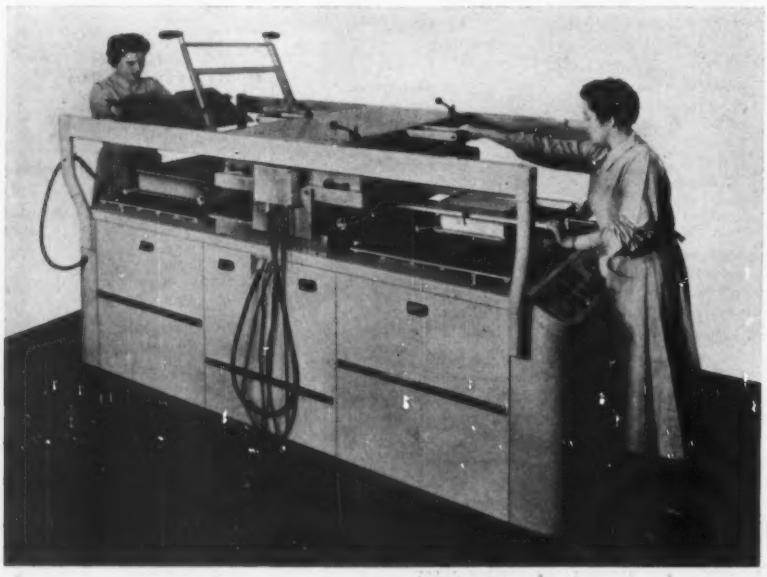
Supporting frames are of the universally adjustable type (one hinged to each plate) and are said to be capable of handling any size of sheet clamping frame. The equipment is designed for automatic and continuous operation. Heating cycles can be pre-set by means of electronic time clocks (from 5 to 120 sec.) for each composition and gage of sheet. Vacuum is automatically actuated following completion of each cycle. Different cycles for each mold plate may be pre-set, so that different types and gages of sheet may be processed simultaneously. Except for the indicating pyrometer and the main switches, all controls are provided in duplicate, each operator having a complete instrument panel (vacuum on-off switch, compressed air lever, mold raising and lowering lever with dial for pre-setting travel, pressure and vacuum gages, thermocouple thermometer, heat cycle time clock, and soft sheet process switch), facilitating continuous operation.

The machine is of open-head design, enabling sheet to be fed from rolls to mold plates, thereby combining cutting-off and stamping-out operations.

An operator's handbook, containing operating and maintenance instructions as well as information on how to make molds and print on thermoplastic sheet is supplied with each unit. Specifications follow:

Specifications

Length	96 in.
Width	45 in.
Over-all height	51 in.
Height of mold plates	33 in.
Max. molding area	24 by 36 in.
Max. depth of draw	4 in.
Weight (approx.)	2200 lb.
Power consumption (app.)	10 kw.



Hydro-Chemie's vacuum molding machine for thermoplastic sheet has 8- to 14-sec. cycle

Temperature control—The distinguishing feature of a new heat control unit introduced by West Instrument Corp., 525 N. Noble St., Chicago 22, Ill., is the absence of relays and the provision of stepless temperature control, which acts to supply just enough power to the heating element to hold the temperature for which it is set. The heater operates at full power only on the initial temperature rise.

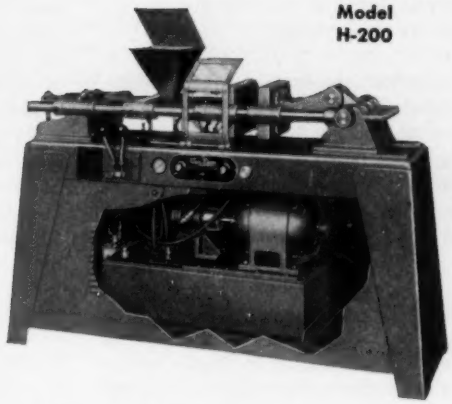
The instrument is composed of two sections (except for higher capacity units where intermediate amplification is required). One contains the temperature indicator, parts of the instrument control circuit, and the control pilot lights; the other houses the heavier parts of the controller circuit. Two pilot lights are used, one to indicate that power is applied, the other to indicate by its degree of brightness the degree of power supplied to the heating element on the unit being controlled. The true temperature is indicated on a 5-in. scale in the temperature indicator unit, mirrored for parallax correction. The

Model H-200

SEMI-AUTOMATIC INJECTION PRESS

2-oz. capacity. Van Dorn's engineering experience has scored again with this leader among all injection presses of its class. Its ultra-modern design insures faster operating cycles—up to 6 per minute. Push button controls are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.

Model H-200



Power Operated, Lever Controlled Presses—Available in 2-oz. or 1-oz. models. These profit-makers feature: Rugged all-welded construction; built-in safety devices; heating chamber with ample plasticizing capacity.

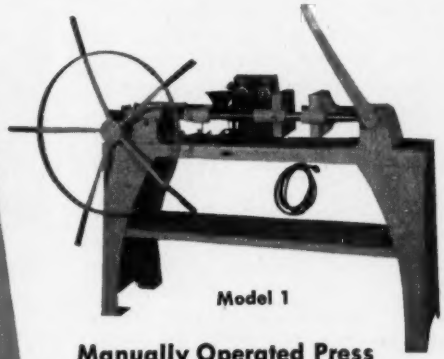
VAN DORN
Plastic Equipment

COSTS LESS to Buy...to Operate!

Van Dorn presses are *unexcelled in efficiency* and *unequalled in economy* on the innumerable jobs where a 2-oz. injection is ample. Costwise, Van Dorn presses are outstanding for these reasons:

1. **Surprisingly low in price**
2. **Operate 8 hours for a few dollars**
3. **Use less expensive molds**
4. **Easily set up by one man in a few minutes**

These presses mold practically all thermoplastics including nylon . . . Look over the Van Dorn presses and plastic equipment shown—*then write for detailed Bulletins on individual machines.*

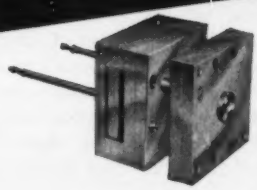


Model 1

Manually Operated Press
1-oz. capacity. Ideal for smaller jobs, experimental work, training.

Plastic Grinder
Grinds up rejects, waste, etc., for re-use. Ruggedly made, easily cleaned.

Model G-100



Mold Bases
. . . Available from stock for all Van Dorn presses.

THE Van Dorn IRON WORKS CO.
2687 EAST 79th STREET • CLEVELAND 4, OHIO
Cable Address: "VANDORN" Cleveland

unit comes in models designed to handle loads in the 300-v.-amp. to 100-kv.-amp. range.

Neutralizer—Static electricity generated during coating, calendering, drying, and similar plastics processing operations is eliminated by the Herbert Oxy Cold Bar, manufactured by Herbert Products, Inc., 77-32 Jamaica Ave., Woodhaven, N. Y.

The device consists of a transformer which supplies current to a number of flexible points embedded in a laminated plastics tube of specified length, causing ionization of air between the emitter points of the bar and the surface of the materials on which static electricity is present. This ionization acts to neutralize the static charge. Although high voltage is applied at the emitter points, current is controlled so that no shock, sparking, or arcing can occur.

The unit is said to be easily installed, even in confined places, and to require no maintenance. It can be supplied in 6- to 100-in. lengths.

Sander—Mounting directly on a motor and requiring no bench anchoring, the "FF" Gordo Belt Sander, produced by John P. Fox Co., 5514 York Blvd., Los Angeles 42, Calif., can be used either as portable or stationary equipment. Direct attachment to motor has the added advantage of eliminating the need for "V" belt drives.

The unit uses 42- to 46-in. long belts, 1 in. wide. It has a reversible tilting work table and semi-automatic, self-leveling tension adjuster.

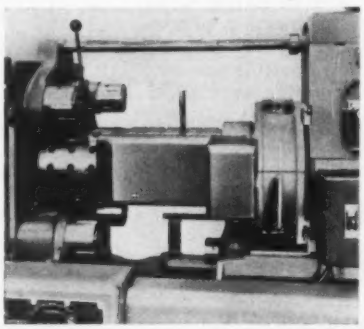
Valves—Recommended by the company for speeds up to 600 c.p.m., two ¼-in. 4-way direct solenoid operated poppet-type valves have been designed by Hannifin Corp., 1154 S. Kilbourn Ave., Chicago 24, Ill.

Principal use of these valves (Models CC1-25 and CC11-25) is expected to be in the electric control of small, double-acting air cylinders on short stroke, high speed applications, such as switching mechanisms for conveyors, welder cylinders, and clamping and work positioning cylinders on various automatic and semi-automatic machines.

Model CC1-25 is of the single-solenoid type; its single valve stem is spring returned. Model CC11-25 has two solenoids, and its single valve stem remains at either end of its short stroke until the other solenoid is momentarily energized to return it. This eliminates the need for a "holding" relay and the danger of accidental cylinder reversal.

The valves have full capacity, with internal passages at least as large as the I.D. of standard weight ¼-in. pipe.

Heater—New 32-oz. heating cylinder offered by Reed-Prentice Corp., Worcester 4, Mass., is said to take the place of a pre-plasticizing unit when installed on the company's model 10D-12-oz. injection molding machine. The added plasticizing capacity of the larger heater is claimed to produce strain-free parts on fast cycle, particularly useful in molding



Reed-Prentice's 32-oz. heating cylinder can take place of pre-plasticizing unit on company's 10D-12-oz. machine

polyvinyl and high impact styrene material.

To accommodate the 32-oz. cylinder, the plunger housing bed of the 10D-12 machine must be repositioned and flexible hydraulic hose lines added. An additional pyrometer for further temperature control of the heater is also required. The unit can be installed on machines now in operation or furnished as original equipment on new machines.

Vacuum Metallizer—Compactness and automatization are featured in the new 72-in. vacuum metallizing unit developed by F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia, Pa.

Rapid pumpdown of the 72-in. diameter, 60 in. long chamber is accomplished by a three-stage pumping system comprising a 500-cu. ft./min. rotary mechanical pump for roughing, a 6-in. booster pump, and three 14-in. oil diffusion pumps. The three diffusion pumps are connected, without a manifold, directly to the rear face of the metallizing chamber for compactness and a more rapid and efficient pumping cycle. Solenoid-controlled air-operated poppet valves of the disk type are installed in the vacuum lines from the chamber to each of the vacuum pumps. The pumping system is said to be capable of evacuating the chamber to a pressure of ½ micron in 7 minutes.

In operation, pushing a button on the control panel starts the rough pumping and automatically closes all valves opening from the vacuum chamber, except the one to the mechanical vacuum pump. When the rough vacuum pressure gage reads 200 microns, the operator pushes a second button which closes the valve from the chamber to the roughing line and opens the three valves to the diffusion pumps and the smaller one to the booster pump. When the pressure has been reduced to ½ micron, the chamber is ready for flashing the filaments and depositing the metal coating on the parts to be plated. Filament heating current can be raised to the flashing point and held there either by an automatic flashing cycle or by manual control. Power is furnished by a 35-kva. supply system with which the unit is equipped.

After metallizing is complete, pushing a third button closes all the valves leading out of the chamber and, after a time interval, trips open another valve admitting air into the chamber, thus safeguarding the diffusion pumps against oil contamination and oxidation.

Printing Machine—Featuring an endless ground face rubber covered blanket, this 4-color flexographic printing press, manufactured by Lembo Machine Works, Inc., 248 E. 17th St., Paterson 4, N. J., finds particular application in the printing of extensible films such as polyethylene. The machine has been designed for polyethylene tubular or flat sheets, but, with an alternate rewind, will also print cellophane, paper, and textiles.

The belt (a close-up of which appears on p. 171, top photo), properly treated, acts like a pressure-sensitive adhesive tape, temporarily adhering the film to it so that there is no movement of the film during print-

BARBER COLMAN

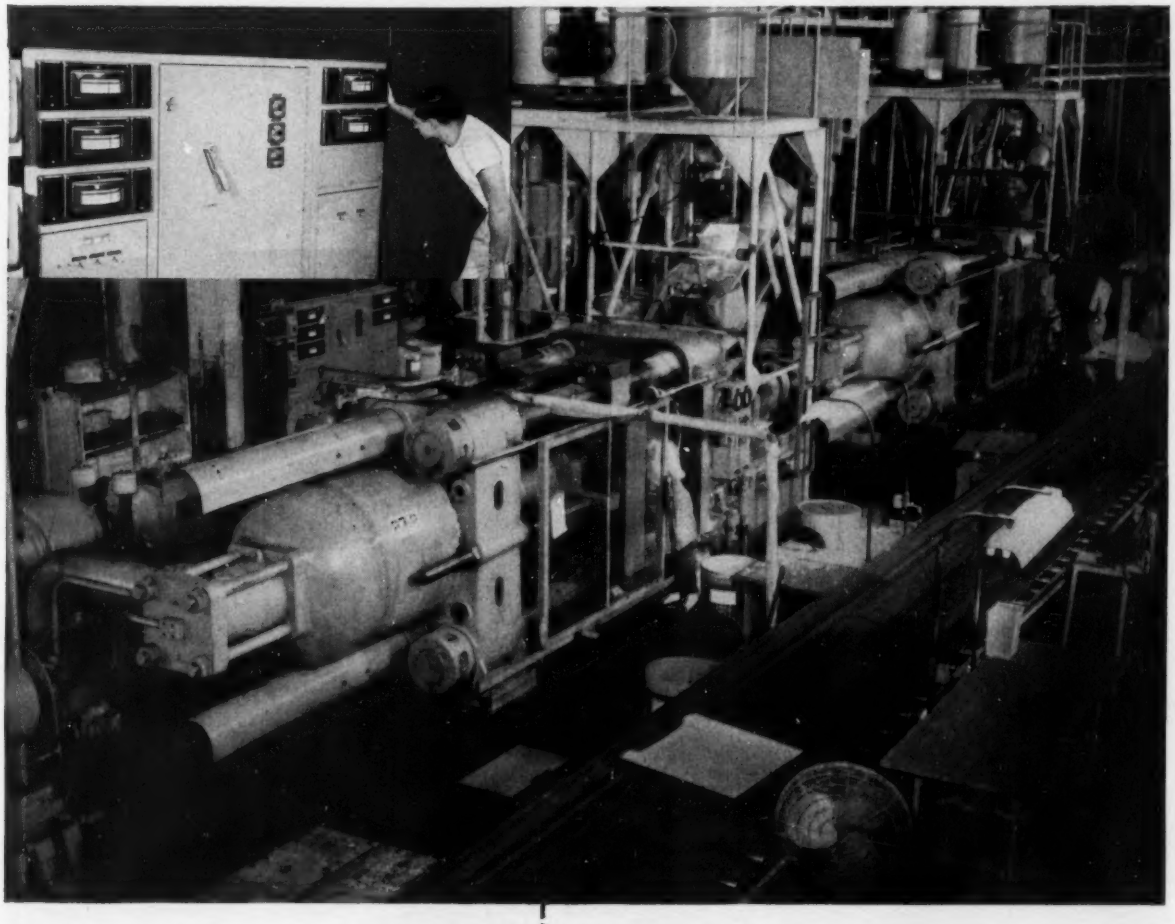
Wheelco Instruments

put temperature control jobs on low-maintenance diet at

GENERAL AMERICAN TRANSPORTATION CORP.

High-quality moldings that provide stunning sales appeal for today's television sets, radios and refrigerators are produced on some of the world's largest presses at General American Transportation Corporation—Plastics Division. Wheelco Instruments are used to control injection temperatures with *hairline* accuracy at lower cost.

Five Wheelco Panelmount Capacitrols control heating cylinders on the 300 oz. presses shown below. They simplify and save on instrument maintenance, help boost production, and improve product uniformity—results you can expect from only the finest instruments. You get faster, more economical servicing of Capacitrols because of their simplified plug-in unit design. You get lightning-fast control action, too, because there is *no physical link* between measurement and control circuits. If you're not getting these results from your temperature control instruments, phone your Wheelco field office and find out *why!*



Write for Bulletins F5783-1 and F5345
Factory-trained field engineers in all principal cities

BARBER-COLMAN COMPANY, ROCKFORD, ILLINOIS
Industrial Instruments • Automatic Controls • Air Distribution Products
Aircraft Controls • Small Motors • OVERdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

WHEELCO INSTRUMENTS DIVISION
BARBER-COLMAN COMPANY, DEPT. L, 1517 ROCK ST., ROCKFORD, ILLINOIS

Gentlemen: I'm interested in learning more about Wheelco Instruments for plastics. ☐ Please send free Bulletins F5783-1 and F5345. ☐ Send free data book on thermocouples designed for plastics machines.

Name_____

Firm Name_____

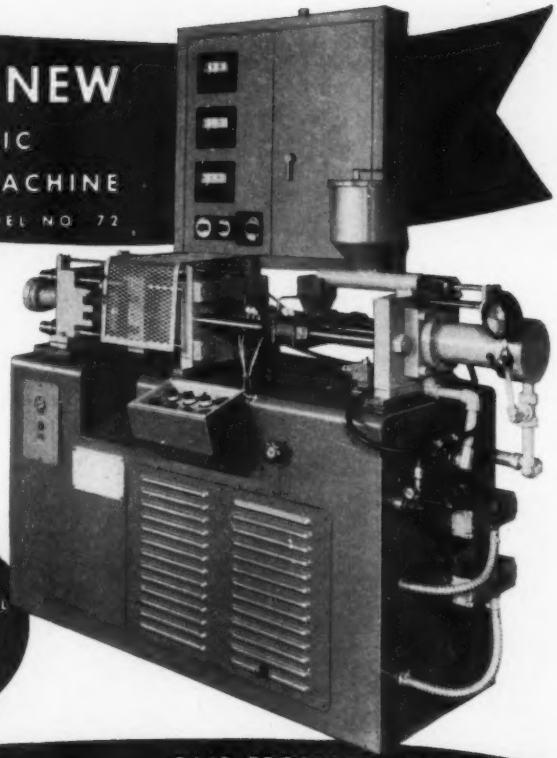
Address_____

City_____ State_____

ANNOUNCING THE NEW

2 OUNCE MOSLO HYDRAULIC PLASTIC INJECTION MOLDING MACHINE

MODEL NO 72



Here is the Moslo 2 Ounce Horizontal Hydraulic Plastic Molding Machine you have been waiting for, to do production molding of small pieces with low mold cost. Built along the lines of larger machines it will shoot a 2 ounce plus shot, and will hold better than 20½ square inches of molding area. Our special 4 Point Toggle Clamp with calibrated adjusting nuts for mold alignment together with the famous Moslo "Radee" Cylinder of stainless or nickel steel guarantees the above statement.

OTHER FEATURES ARE

Dry Run
Manual, 1 cycle and Repeat cycle performance
25 lbs Material Plasticizing Capacity
8 x 9 Std. D.M.E. Mold blanks
7" Injection stroke
1½" Injection Ram water cooled
12,100 PSI Max Pressure
14 lb Material Hopper
Vickers Pump Equipment
Taco West Heat Control Inst.
5 H.P. Motor

525 Cycles

Write for additional and full information.

WRITE FOR ADDITIONAL AND FULL INFORMATION

COMING SOON

Model No. 73—1200 shots per hour. Fully automatic. On demonstration in Cleveland. Come in and see it operate.

MOSLO MACHINERY COMPANY 2443 PROSPECT AVE. CLEVELAND 15, OHIO

PICTURED ABOVE IS OUR MODERN SHOP AND OFFICES housing over 14,000 square feet of floor area exclusively devoted to engineering and fabricating molds to exacting specifications. This plant was designed to keep abreast of the custom molders' tooling demands, with necessary ceiling and floor load capacities required to fabricate molds up to the 12 ton television cabinets which we have recently completed.

RICHARD O. SCHULZ CO.

ELMWOOD PARK, ILLINOIS

●

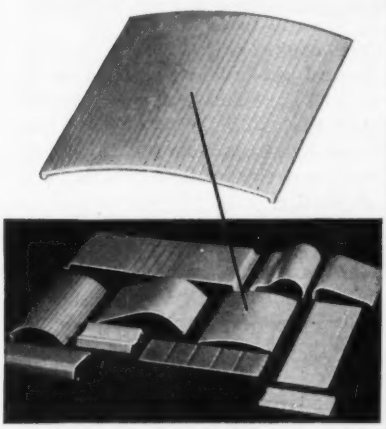
DIE CASTING DIES • PLASTIC INJECTION AND COMPRESSION MOLDS

FOR RIGID EXTRUSIONS TO RIGID SPECIFICATIONS

Specify...

SHEFFIELD PLASTICS

Custom shapes in every conceivable contour can be extruded by Sheffield... quickly... flawlessly... and to your exacting requirements. Rigid plastic extrusions for routine or intricate applications can be designed, developed and produced by Sheffield technicians.



Working with polystyrene, acrylic, rigid vinyl and other conventional, non-flexible thermoplastic materials, Sheffield can bring new beauty and lasting durability to your product. Quotations promptly presented for your approval.

Get full details on Sheffield's Facilities — and how they can work for you! Send TODAY for the new Sheffield brochure.

SHEFFIELD PLASTICS INC.

SHEFFIELD, MASS.

CONTACT YOUR SHEFFIELD SALES REPRESENTATIVE

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Phone: Locust 4-0456

Mr. Ward A. Robinson
473 Washington Street
Wellesley, Massachusetts
Phone: 5-5111

Mr. James W. Whitfield
6006 Onondaga Road
Washington 16, D. C.
Phone: Executive 3-5640

Mr. B. W. Massmon
Rm. 15—12417 Cedar Road
Cleveland 6, Ohio
Phone: Erieview 1-0054

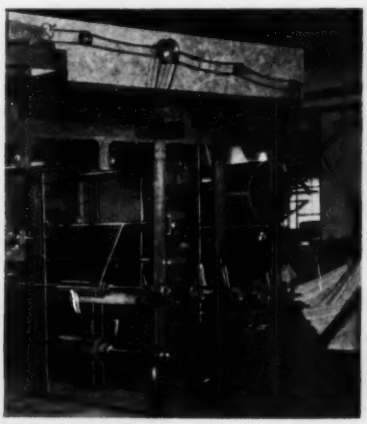
Lembo's flexographic press features adhesive belt which prevents side-way motion of film during printing

ing, assuring perfect registration. Belt and film separate when the former starts on its downward cycle.

Registration is either planetary or electronic. Wind and unwind units (shown below) are controlled for constant tension. The unwind unit is equipped with a special splicing attachment to enable printing from roll to roll without stoppage and a minimum amount of waste at the end of each roll. Rated speed is from 45 to 315 ft. per min., or, with a specially designed Reliance V.S. drive, from 0 to 500 ft. per minute.

The company claims that this press will print rotogravure with a minimum of changeover.

Rear view of Lembo's 4-color press shows wind and unwind units, both controlled for constant tension



Keep Odor at a Minimum

in Processing and in Finished Product

the odorless dialkyl phthalate

STAFLEX® MP

A quality upgrading replacement for dioctyl phthalate

Reduces Processing Loss

STAFLEX MP has exceptionally low volatility. The resultant decrease in fuming during processing can save you about ½ cent per pound of plasticizer.

Typical Results in Plastisols

Age	Viscosity DOP	Viscosity STAFLEX MP
0 days	5,000	3,800
30 days	8,700	5,000
90 days	11,400	6,000

Other Benefits

1. Improves water, soap and age resistance.
2. Allows longer storage of plastisols.
3. Low specific gravity.

Available in Drums and Tanks

Write for STAFLEX MP Technical Bulletin and Samples.

DEECY PRODUCTS CO.
PLASTICIZERS STABILIZERS
120 Potter St., Cambridge 42, Mass.

INTERNATIONAL PLASTICS NEWS*

Activities Around the World of Interest and Importance to the Plastics Industry in the United States

Coating machine—The first polyethylene coating machine ever set up in Italy has been installed near Venice for Cartiere-Burgo, one of the largest paper manufacturers in the country. The installation was supervised by William H. Willert, sales engineer for Frank W. Egan Co., Bound Brook, N. J.

Company expansion—A polymerization plant to meet the need for resin polymers for many South American industries, has been opened in Sao Paulo, Brazil, by Polymer Produtos Quimicos do Brazil, an associate company of American Polymer Corp., Peabody, Mass. The plant was designed and constructed by American Polymer in the U. S. and shipped to Brazil through its export department. Dr. Ryan of American Polymer will be in charge of production for the Brazilian company.

American Polymer Corp. also announces the completion of a manufacturing license agreement with Scott Bader & Co., Ltd., Northants, England. The license permits Scott Bader & Co. to polymerize emulsions and solutions based on acrylic, vinyl, styrene, acrylonitrile, and vinyl chloride monomers for use by the paint, adhesive, paper, and flooring industries.

Customer relations—During a seven-week European tour, ending December 3, Franklin R. Hoadley, president, Farrel-Birmingham Co., Inc., Ansonia, Conn., visited customer firms in England, France, Holland, Italy, Germany, and Sweden.

Information exchange—An arrangement for the mutual exchange of technical information on the processing and styling of plastics materials has been made between Textileather Corp., Toledo, Ohio, and several overseas plastic cloth and sheeting manufacturers. The agreement resulted from a visit made by J. D. Lippmann, president of Textileather Corp., to such leading foreign firms as Sincrusta, Inc., and la Compagnie Lincrusta, both of Paris, France; Pfalzische Gummiwerke, Frankentaal, Germany; and Dornbusch Co., Krefeld, Germany.

Mr. Lippman is also reported to have made similar exchange agreements with several machinery manufacturers concerning new developments which would have a material effect on the plastics coated fabrics industry.

Branch office—The chemical engineering firm of R. S. Aries & Assoc., New York, N. Y., has opened a branch office in San Juan, Puerto Rico. The office will handle technical and economic work on new industries as well as consultation to local companies and those in neighboring areas. It will be located at 656 Ave. Munoz Riviera, and will be under the direction of Fernando Badrena, Jr.

Expansion in the East—In line with the growing importance of the plastics industry in the East, several countries in that part of the world have been the scene of recent activity on the part of the industry.

Clayton S. Shoemaker, president, Dow Chemical International Ltd., paid a visit to Pakistan in order to explore the business and industrial possibilities that that country offers the plastics industry. In Japan, Dow Chemical International recently established a plastics plant, in collaboration with Japanese industrialists.

In Calcutta, India, a service laboratory has been established to render technical assistance to molders. Special training courses in molding will also be offered.

Technical director—Plastin Industria e Comercio de Plasticos, S. A., has appointed Robert L. Fish as technical director in charge of the installation and operation of a plant which will be located in Rio de Janeiro, Brazil. The facilities will be used for the manufacture of plastics film, sheeting, and extrusions. The equipment and machinery for the plant were acquired in the United States through Transmundo Co., New York, N. Y.

Plastics exposition—The Norwegian Plastics Federation, in cooperation with the Norwegian Industries Development Association, has arranged an International Plastics Exhibition to be held in Oslo in 1954 from May 31 to June 9. Both Norwegian plastics firms and foreign manufacturers of raw materials and machinery will participate.

The aim of the exhibition is to show the standing and development possibilities of the plastics industry in Norway today, as well as to inform engineers, technicians, and the general public about possible applications for plastics. In connection with the exhibition, a series of lectures has been arranged to discuss various problems current in the field of plastics.

Vinyl plant—Monsanto Mexicana, S. A., a wholly-owned subsidiary of Monsanto Chemical Co., has opened a new plant in Mexico City for the manufacture of polyvinyl chloride resin. This is the first plant of its kind in Mexico with sufficient capacity to accommodate the present needs and the planned expansion in the polyvinyl chloride consuming industries in Mexico.

Synthetic fibers symposium—The Plastics and Polymer Group of the Society of Chemical Industry, London, will hold a symposium on the chemistry and physics of synthetic fibers. It will be held March 24 to 26, 1954, in the lecture theater of the Institution of Electrical Engineers, Savoy Place, London, W. C. 2. Papers to be presented and discussed will cover the chemical and physical basis of fiber formation and the properties of fibers in relation to the molecular structure and conditions of formation.

Company consolidation—In a move intended to effect a closer liaison between sales and production staffs, the sales division of R. H. Windsor Ltd., has been transferred from London to the head office and production plant at Leatherhead Road, Chessington, Surrey.

* Reg. U. S. Pat. Off.

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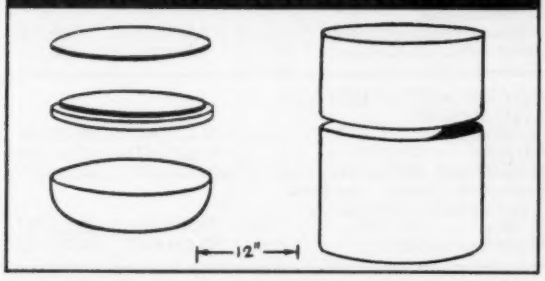

The Chemold Company is presently equipped to mold glass fiber polyester parts like those shown above and below. In addition to flat or ribbed sheets 32" x 96", other compound curvature shapes may be produced 3' wide by 8' long, or 6' wide by 6' long using Chemold's 200-ton steam-heated hydraulic presses.

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. first 8 mos. 1953*	*Total sales first 8 mos. 1953*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	10,745,104	10,628,149
0.003 gage and over	9,188,058	8,760,242
All other sheets, rods and tubes	3,931,809	3,403,880
Molding, extrusion materials	50,795,014	50,258,554
Nitrocellulose:		
Sheets, rods, and tubes	5,069,413	4,389,836
Other cellulose plastics[b]	4,580,523	4,636,641
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	56,357,944	40,449,406
Adhesive	36,829,947	32,974,736
Molding and casting materials[a]	154,495,120	144,668,683
Protective coatings (modified and unmodified except by rosin)	20,580,561	18,218,737
Miscellaneous uses	47,504,844	50,702,653
UREA AND MELAMINE RESINS:		
Adhesives, including laminating	56,505,373	55,522,447
Textile-treating resins	20,169,503	20,414,346
Paper-treating resins	14,948,467	14,646,903
Protective coatings, modified and unmodified	19,360,096	14,850,488
Miscellaneous uses, including molding[c]	48,241,832	49,556,195
STYRENE RESINS:		
Molding materials[a]	233,408,917	201,700,852
Protective coatings, modified and unmodified	56,100,091	54,452,167
Miscellaneous uses	56,362,738	49,451,623
VINYL RESINS:[d] Total	357,208,484	322,067,666
Sheeting and film (resin content)[e]		97,987,576
Adhesives (resin content)		14,889,939
Textile and paper-treating resins (resin content)[f]		33,842,497
Molding and extrusion materials (resin content)		103,750,657
Protective coatings (resin content)		17,983,545
Miscellaneous uses (resin content)		39,841,936
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	114,885,240	111,832,694
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS		
Molding materials[a,g]	88,280,905	81,261,082
Protective coatings[h]	5,598,400	3,238,557
All other uses[i]	85,731,454	87,980,896

[a] Dry basis is designated unless otherwise specified. [b] Includes fillers, plasticizers, and extenders. [c] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS[a] FOR JULY AND AUGUST 1953
by U. S. Tariff Commission

July 1953		*August 1953*	
Production	*Sales*	*Production*	*Sales*
1,199,805	1,150,446	1,160,741	1,282,242
1,125,913	1,074,442	1,225,517	1,144,129
391,669	261,133	461,898	447,021
5,348,830	5,461,058	6,259,087	6,138,392
522,193	457,298	596,559	497,015
476,391	393,310	448,623	557,285
5,088,337	4,083,831	5,775,286	4,089,597
2,096,444	1,871,215	2,858,062	2,694,683
16,572,376	13,878,736	18,417,255	15,343,629
2,053,313	1,661,177	2,281,904	2,037,424
8,604,776	6,767,529	8,713,447	6,942,338
7,351,629	7,567,213	7,073,612	7,063,825
1,485,534	1,787,959	2,156,775	2,475,645
1,796,588	1,818,608	1,786,894	1,698,610
1,897,647	1,685,047	2,224,768	1,762,403
3,111,204	4,020,651	5,329,792	4,949,814
26,886,590	21,821,273	32,114,633	22,516,213
5,963,923	5,228,389	6,533,195	6,146,510
5,512,820	4,913,736	6,563,223	5,106,702
40,392,090	33,480,842	43,591,858	36,180,124
	7,458,412		9,512,120
	1,859,401		1,720,878
	3,376,798		3,850,894
	8,579,729		8,650,088
	1,797,952		1,850,116
	10,408,550		10,596,028
10,614,842	10,942,082	13,671,774	12,312,365
9,837,029	7,463,354	10,472,827	10,049,518
921,345	351,076	604,672	403,164
9,338,668	11,191,876	8,795,028	9,503,109

tion are given. [a] Prior to January 1951, statistics were given on the basis of total weight. [c] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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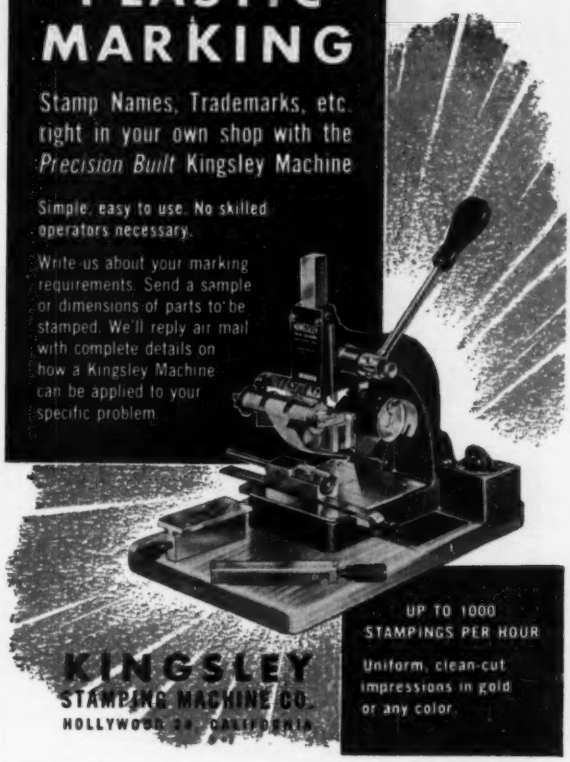

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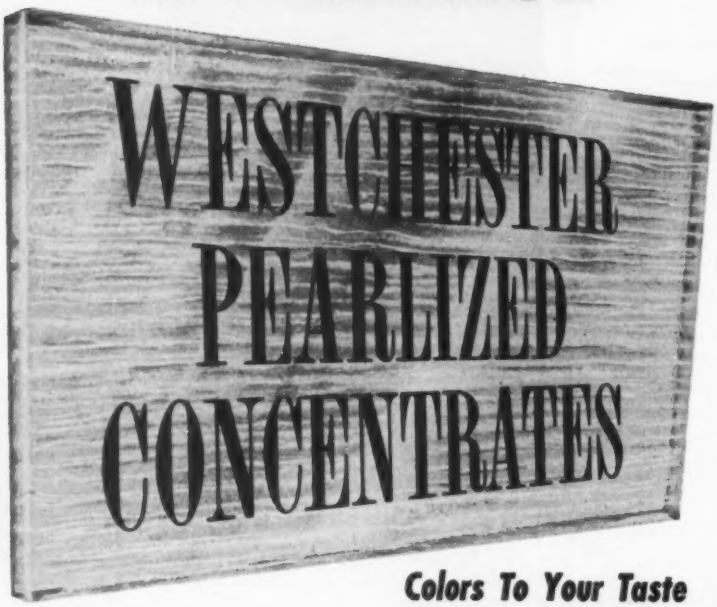

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Polyethylene-cellophane container dispenses individual liquid food portions

"Pitcher" Package

POLYETHYLENE bag container, designed to look, pour, and stand up like a standard pitcher, is a unique development in the field of individual food servings.

Originally introduced as a container for maple syrup, the package will now be made available for licensed use by manufacturers of other liquid foods. Non-breakable, leakproof, and sanitary, the package is particularly adaptable for the needs of hotels, railroads, and airlines, where it eliminates product waste and cuts the costs of washing and filling glasses or other containers.

The "Pitcher-Pour" is made of polyethylene film and cellophane. The cellophane is on the outside and is reverse-printed with an illustration of a transparent pitcher on a bright yellow background before being laminated to the polyethylene; the tough, transparent polyethylene film is sealed by a special process to the cellophane to provide sufficient reinforcement and to permit the package to maintain a certain degree of rigidity even when empty. A flanged bottom helps the container to stand erect.

The contents of the package are visible through the transparent pitcher. When the unit is to be used, a perforated line running across the spout of the simulated pitcher is easily torn open and the contents of the package poured out.

CREDITS: *Package developed by Holbert Bros., Onamia, Minn.*

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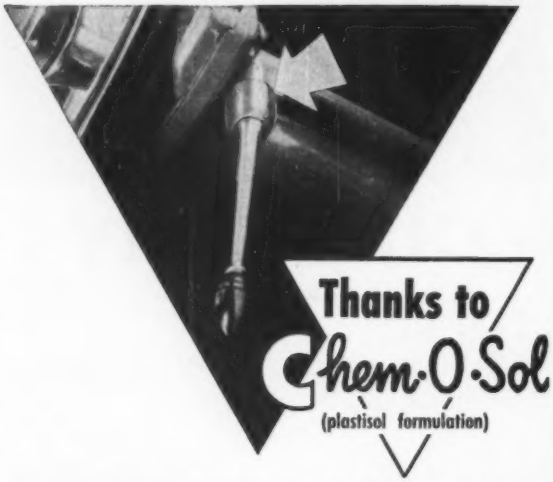

Automotive gearshift lever covers of colorful Chem-O-Sol (vinyl plastisol) resist cracking, peeling or fading. Furthermore, they seal out dust and moisture. An improvement over molded rubber, Chem-O-Sol is pigmented to any desired shade to match the overall color scheme of any car interior.

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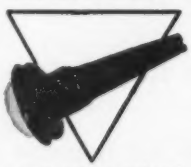
You can easily find out how to take full advantage of this unique plastisol material. Tell us your requirements. Without obligation, we'll help you evaluate the utility of Chem-O-Sol for your product.

Other Uses of Chem-O-Sol



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Styrene Water Supply Container

A SEPARATE all-styrene supply reservoir for water is designed to keep the weight of a steam iron down and provide it with sufficient water capacity to permit its uninterrupted use for relatively long periods of time.

The container, introduced by Sunbeam Corp., Chicago, Ill., is molded of translucent white styrene and has a grey styrene cover. When in use, it is supported by a metal pedestal clamped to the end of the ironing board and is connected to the iron by means of a small-diameter rubber tubing. Since the bottom of the reservoir is approximately one foot above the iron, water is fed into the appliance by gravity flow. By thus eliminating the need for a water supply chamber in the iron itself, the total weight of the appliance is kept to 2¾ lb., making it one of the lightest irons of this type which has ever been made.

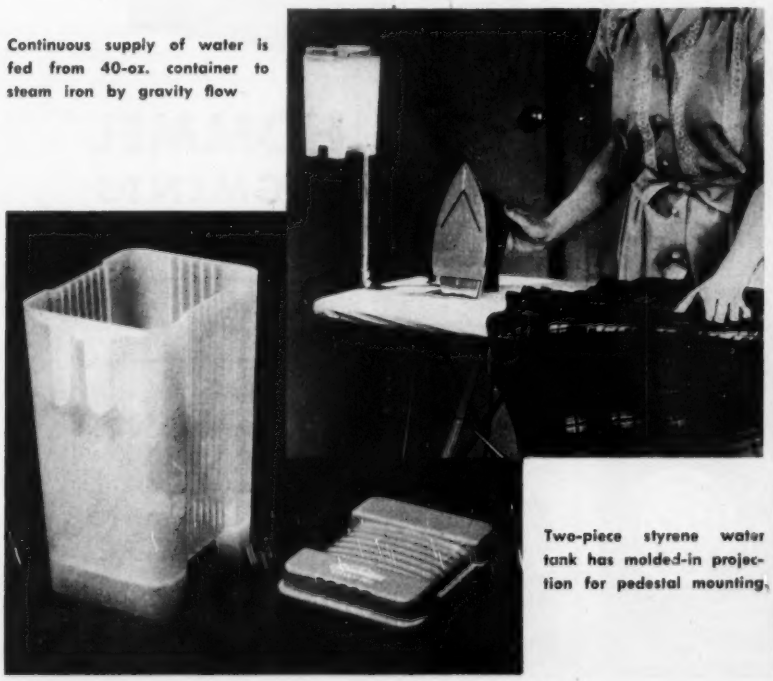
Once the appliance is turned on and water begins to flow from the container, sufficient steam for ironing will be generated within only 90 seconds. Because of the even flow of water from the container, the Sunbeam iron makes 70% more steam per min. than competitive irons. The reservoir holds 40 oz. of water, enough for two hours of continuous steam ironing without stopping the work to replenish the water supply.

An additional convenience offered by the separate container is the ability of the user to switch immediately from steam to dry ironing and back again, as often as desired.

The styrene water reservoir, including the removable cover, stands 7½ in. high and has a fine metal mesh mounted in the opening at the bottom of the unit to serve as a screen against any foreign matter that might tend to clog the tube or steam generating chamber. An attractive fluted design along the sides of the container contributes to ease in handling; on one of these sides is a grooved projection into which the metal pedestal is secured, making for easy set-up.

When not in position on the ironing board, the container stands securely upright on its platform type base. Because of the translucency of the styrene, the water level may be observed at all times without removing the cover.

CREDITS: Water container and cover made by Chicago Molded Products Corp., Chicago, Ill.



Continuous supply of water is fed from 40-oz. container to steam iron by gravity flow

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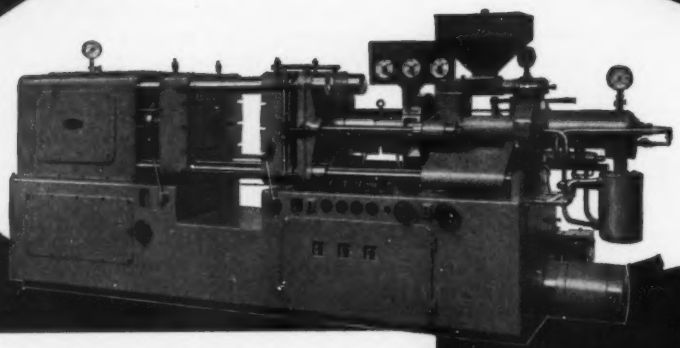

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up to 10 oz. capacity

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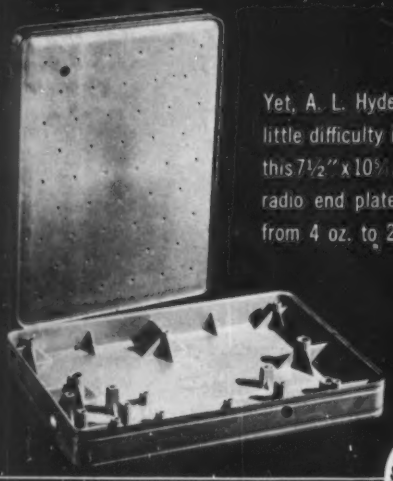

Yet, A. L. Hyde had very little difficulty in molding this 7½" x 10 5/16" x 1 3/16" radio end plate. Presses from 4 oz. to 200 oz.

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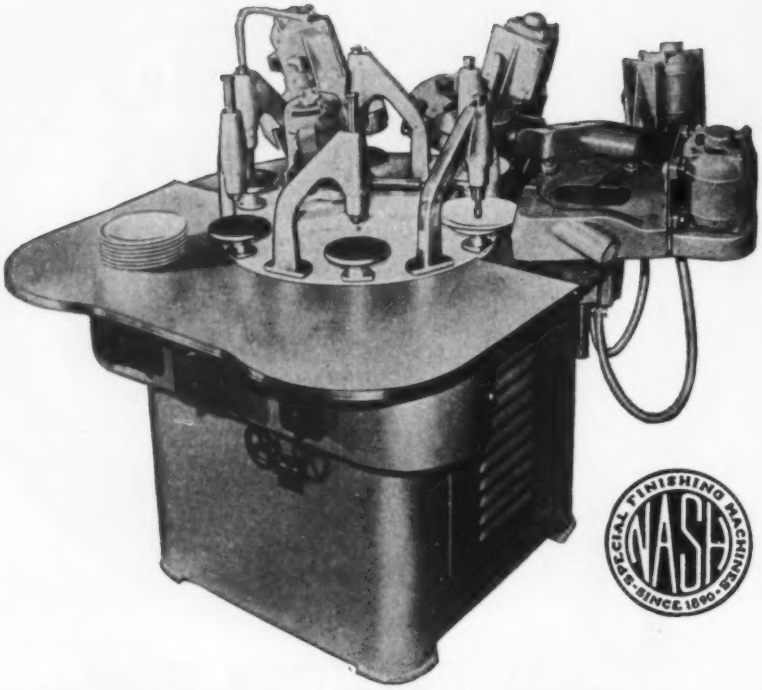
THE extremely high bond strength which results from the impregnation of fibrous glass with epoxy resins has made possible the development of an air storage tank for jet aircraft starting systems that is 35% lighter than a comparable steel tank.

The 13-in. diameter, 16-lb. unit, manufactured by Apex Electric Mfg. Co., Cleveland, Ohio, in cooperation with Bendix Aviation Corp., stores enough air for two jet engine starts, independent of any ground-based equipment. In addition to being shatterproof, even at the extremely low ambient temperatures encountered at high altitudes, the durable tank can operate at 3000 p.s.i.g., and has a burst strength in excess of 7000 p.s.i.g. Its strength is, in fact, so great that, during Air Force acceptance tests, it withstood over 26,000 full pressure cycles from 0 to 3000 p.s.i.g. and back to 0 at 30-sec. intervals, without failure.

To make the tank, a continuous strand of Fiberglas is run through a bath of epoxy resins and then wound around a cast metal mold. During the winding process, this mold is supported on a mandrel, which is screwed into a tapped air connection that has been cast into the mold. A low-melting-point alloy is used for the mold, so that, after the 2-hr. curing period, the mold can be melted out of the finished tank and the alloy recast.

CREDITS: Epon epoxy resins are supplied by Shell Chemical Co., New York, N. Y.

Lightweight air storage unit is made of epoxy impregnated fibrous glass



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On Plastic Dinnerware and Circular Mouldings

with the

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It's the modern way to remove flash from plastic dinnerware and circular moulded pieces. Gives you a perfect finish at the rate of 8 to 24 pieces per minute . . . on mouldings from 3″ to 11″ in diameter.

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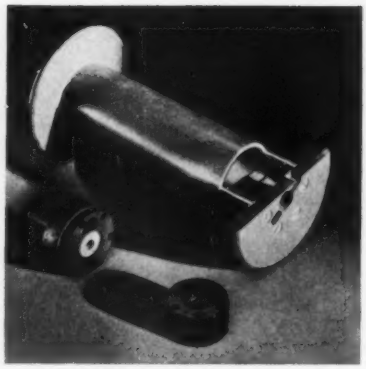
Rapid — Automatic — Accurate

Four high-speed abrasive belt units, universal in adjustment, do the work. They are mounted around the turntable which carries six spindles. Mouldings placed on the spindles then rotate, and as the turntable slowly revolves, are brought into contact with each abrasive belt in turn. The belts have progressively finer abrasives and are wax-impregnated to reduce harsh cutting action and prevent scratch lines. Final buffing belt produces polish on edge of dinnerware.

Write us for engineering details and price data.

J. M. NASH COMPANY

Dept. 116 — 2370 No. 30th Street **Milwaukee 10, Wis.**



Phenolic and laminated plastics parts are used in rugged industrial bobbin

Plastic Bobbin

PRECISION bobbins, designed for the production of high-quality yarns, incorporate plastics parts that strengthen the assembly of the unit and assure its dependable performance while in use.

These parts include a molded phenolic plug, a laminated plastics sheath, and laminated plastics flange and spindle bearing.

According to the manufacturers of the bobbin, Engineered Plastics, Inc., Gibsonville, N. C., all four parts combine to make the bobbin strong enough for use in the manufacture of synthetic yarns—a phase of the textile industry that demands the toughness to withstand the tremendous pressures of nylon and similar tenacious synthetic yarns even under steaming conditions.

The rugged molded phenolic plug, for example, contributes greatly to the working performance of the bobbin. Self-tapping screws are threaded directly through the head of the bobbin and into the molded plug below it to hold the entire assembly together. The laminated plastics used for the sheath, flange, and spindle bearing provide a smooth, hard surface on which the yarns can safely wind and which will stand up under hard wear.

Both the plug and the laminated plastics parts are held to close tolerances during manufacture and are carefully balanced in the final assembly so as to assure smooth operation.

CREDITS: Phenolic supplied by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.

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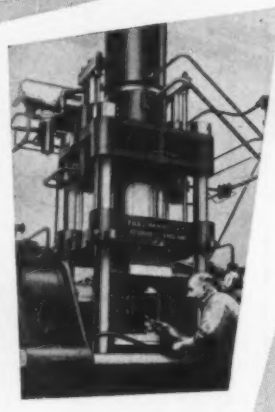
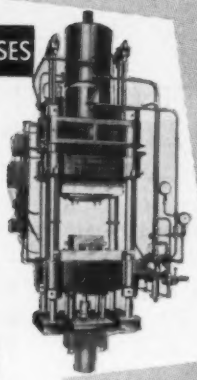
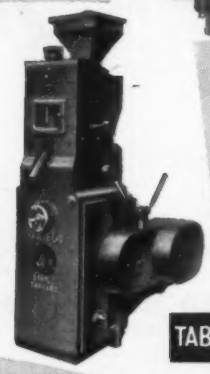


TRANSFER PRESSES



SIDE RAM PRESSES



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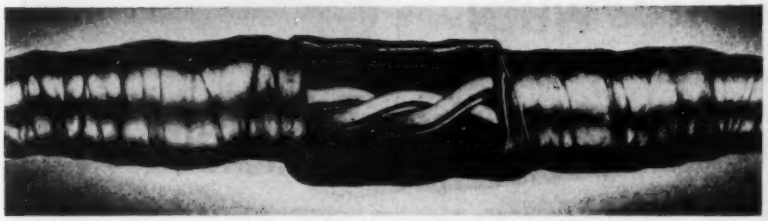


Cut-away view of wire splice insulated with polyethylene tape shows material fused into solid mass having no laminar structure and conforming closely to the conductors

Self-Bonding Polyethylene Tape

COHESIVE tape, unlike pressure-sensitive tape, effects a firm, permanent bond to its own backing when it is wound upon itself. Like the pressure-sensitive tapes, however, (see "Tapes Are Stuck On Plastics," MODERN PLASTICS, *30* 73, May 1953) the cohesives also involve the use of a variety of plastics materials.

Bishop Mfg. Corp., Cedar Grove, N.J., for example, markets a self-bonding insulating tape made from a polyethylene base compound. Originally developed for military applications, particularly for Signal Corps use, the tape is today finding a large-volume market in civilian industries.

The tape, called Bi-Seal, is made from a formulation of polyethylene, synthetic resins, and several other components combined in a rubber mixing mill. From the mill, the compound is rolled through a three-roll calender until it has been reduced to the desired thickness and is then wound onto 36 in. long rolls. A cloth material, which is to act as a separator between the layers of the tape, is simultaneously wound onto the roll with the compound. When the winding operation is complete, the roll of tape is slit to the desired width.

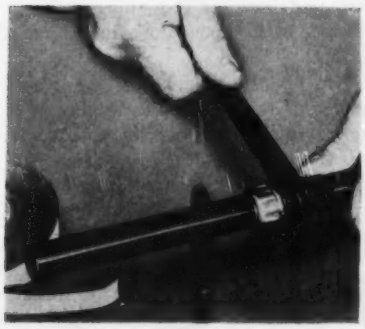
To apply the tape, the cloth separator is stripped away and the polyethylene tape is tightly wrapped around pipe or cable using snug taping tension. The end is then pressed firmly into place. Within a minute or two, the "elastic memory" of the polyethylene causes the tape to contract, with the result that the tape layers fuse into a solid homogenous mass which cannot be unwound.

The chemical, electrical, and physical properties of the tape make it suitable for use in wire and cable splicing, insulating motors, harnessing, coil wrapping, taping bus bars and TV antenna leads, and sealing conduit joints.

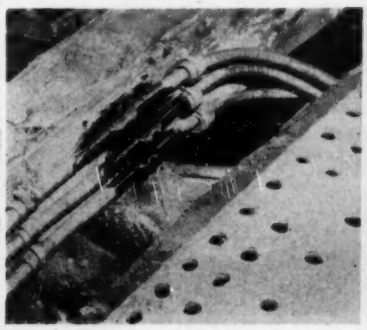
The tape is moisture-resistant and has good aging characteristics. It performs well at temperatures as low as —67° F.; has an average dielectric strength of over 1000 v./mil; and will resist most acids, alkalies, and corrosive soil bacteria. It is available in clear or brown, or in a special black for out-of-doors applications.

CREDIT: Polyethylene supplied by Bakelite Co.

Effective seal is produced by simply winding tape around joint



Polyethylene tape protects these underground 440-v. cable splices



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REZ-N-LAC, developed especially for styrene products, is non-toxic, non-crazing, and cannot scratch off. Clear, white, transparent or opaque colors.

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Developing an improved method of silverware handling, the Steril-Sil Company of Boston, Mass., required washing cylinders that were light — easy to handle — tough enough to withstand heavy restaurant usage without distortion and damage. The answer was a 100% nylon component — produced from molds by Parker. These molds — engineered and built to exacting functional standards — met all requirements of production perfection.

These patented nylon cylinders resist corrosion due to dishwashing compounds and withstand maximum temperature changes — work better, last longer than metal previously used.

Every rigid specification of design and performance was faithfully met by Parker. The result — a product that functioned flawlessly—was produced in less time, at less cost.

Thousands of cylinders have been molded by the Bolta Company, Lawrence, Mass., from this Parker die. One more typical example of Parker engineering and craftsmanship working with industry to provide new materials and methods for better products.

Investigate the flexibility of Parker's facilities — literature sent upon request.

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PLASTIC MOLD DIVISION
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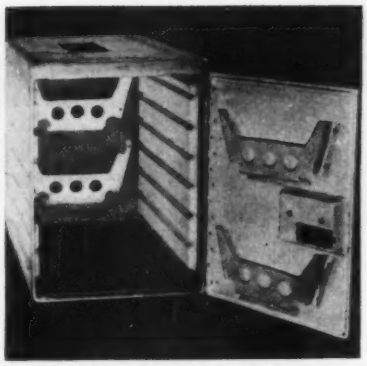


Reinforced plastics cabinet incorporates four holders for dry-ice

Tray Carrier

SAVINGS in weight and cost are made possible by a reinforced plastics food tray carrier being introduced aboard commercial airlines in place of the wood-lined aluminum type which heretofore had been used by them.

The new carriers, which are used for keeping foods cool until they are served, are not only individually lighter than the aluminum units but are so designed that three of the new carriers can accommodate as many trays as four of the old ones. Instead of the double wall construction of the aluminum units, the fibrous glass-reinforced polyester, itself, acts as insulation, and instead of metal runners attached to the inside walls, the new carriers have molded-in grooves to accommodate the trays.

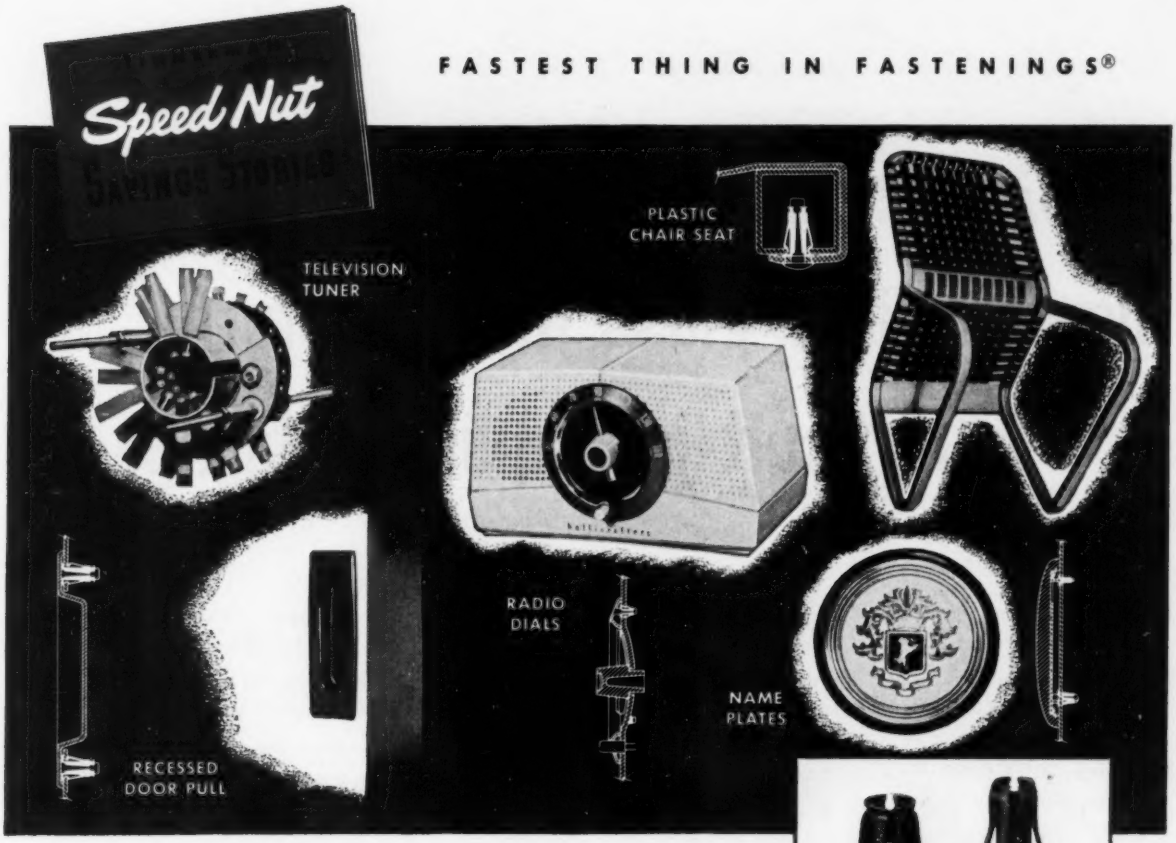
In addition to their light weight, the units are strong, have high heat and moisture resistance, and can withstand frequent washings in commercial dishwashers without being adversely affected.

The two sides and the door of the unit are molded in matched metal molds using glass mat; the top, bottom, and back of the unit are bag molded, using glass cloth instead of mat.

Two containers for dry ice, also molded of reinforced plastics, are attached to the inside back wall and two to the inside of the door to provide necessary refrigeration.

CREDITS: The carriers were developed by American Airlines and by the fabricator, Steiner Plastics Mfg. Co., Inc., Glen Cove, N. Y.; Laminac polyester resin from American Cyanamid Co.

FASTEST THING IN FASTENINGS®



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Makers of plastic products find Tinnerman Tubular Type SPEED CLIPS save time, money, and materials, especially in difficult, "blind" assembly attachments! Production savings of more than 50%, plus substantial increases in output, are being made by the use of Tubular SPEED CLIPS to solve fastening problems in a variety of plastic applications. Hundreds of types and sizes are available. They snap into place by hand, are self-retaining in molded or punched holes; can be easily applied over integrally molded studs; eliminate costly threaded inserts! Material costs, and materials handling are reduced!

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Write direct for SPEED NUT "Savings Stories", and your copy of Tubular Type SPEED CLIP data to: TINNERMAN PRODUCTS, INC., Box 6688, Dept. 12, Cleveland 1, Ohio. *In Canada:* Dominion Fasteners Ltd., Hamilton, Ont. *In Great Britain:* Simmonds Aerocessories, Limited, Treforest, Wales. *In France:* Aerocessoires, Simmonds, S. A. —7 rue Henri Barbusse, Levallois (Seine).

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1. Greater *uniformity*. Bigelow mats give you the very highest standards of *consistent uniformity*.
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3. Wide choice of resins. Lack of chemical binder means greater compatibility.
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FORMAT*—A mechanically bound all-purpose mat which can be used to advantage in almost all the ordinary applications a molder is likely to encounter. It consists of a controlled blend of chopped roving which has been mechanically bound to a thin film of carrier mat. FORMAT's easy drapability is probably the outstanding reason for its widespread popularity.

ROVMAT*—Bigelow's high tensile strength unidirectional mat has continuous strands of roving uniformly distributed in the longitudinal direction on a base of chopped strands and lightweight carrier mat. ROVMAT is well adapted to applications where major stresses are applied in one direction. Also makes an easy sandwich construction.

*Patents pending

FABMAT*—Constructed of a base layer of woven or unwoven glass fabric to which a controlled blend of chopped roving is mechanically attached. Any commercially available glass fabric may be used. If a special weave is required, Bigelow will manufacture it on its own looms. FABMAT comes as close to being a "preform" for sandwich work as possible. It obviates the time and labor expense consumed in cutting and matching layers of cloth and mat.

BIGELOW MATS can be further engineered to meet specific applications. Available in weights from 2 to 8 oz. per square foot. Heavier weight available on order. Their lack of resinous binder offers the molder and laminator a versatile reinforcing material.

Custom woven fabrics available in widths up to 144 inches.

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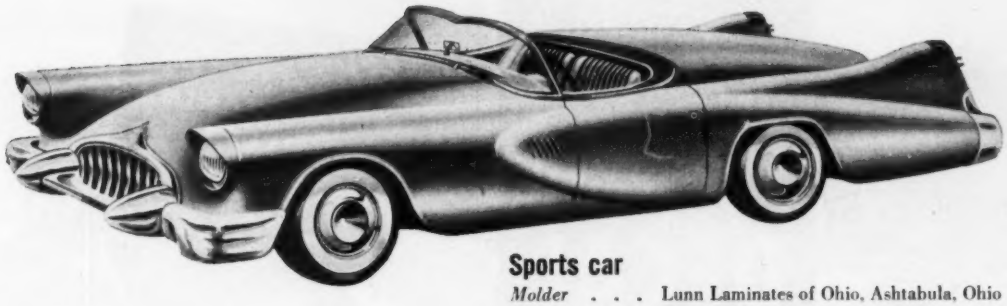
Fiber Glass Products

A division of Bigelow-Sanford Carpet Co., Inc.,
140 Madison Avenue, New York City



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Process . . . Improved Vacuum Bag
Reinforcement . Bigelow 2-oz. mat
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Washing machine tub rim

Molder . . . Apex Electrical Manufacturing Co., Cleveland, Ohio
Process . . . Matched metal molds
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Advantages . . Blends evenly with pigmented resin, formability, *uniformity*

inquiries invited...

BIGELOW Fiber Glass Products, 140 Madison Avenue, N.Y.C. (Dept. P)

Please send me samples and further information on Bigelow fiber glass mats.

Your name_____

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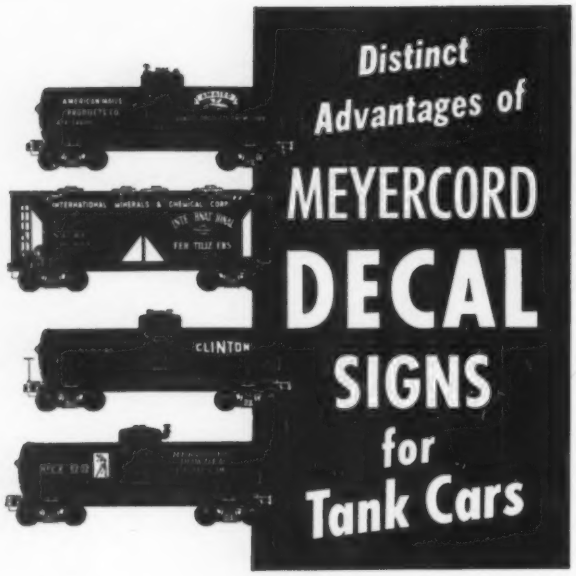

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If your firm operates its own fleet of tank cars . . . we invite you to learn more about the cost-reduction advantages of Meyercord tank car decal signs. Advantage *one* reduces initial cost because the decal sign actually costs less in most cases than a conventional painted sign. Advantage *two* is the reduction in car lay-up time for painting. The decal sign goes on in a matter of minutes . . . on to stay! Advantage *three* is the remarkable durability of the Meyercord tank car decal sign. It is virtually indestructible regardless of weather or chemical action. Advantage *four* is uniformity—there is no such thing as "artistic license" in a Meyercord decal—the integrity of your company trademark is maintained on every vehicle.

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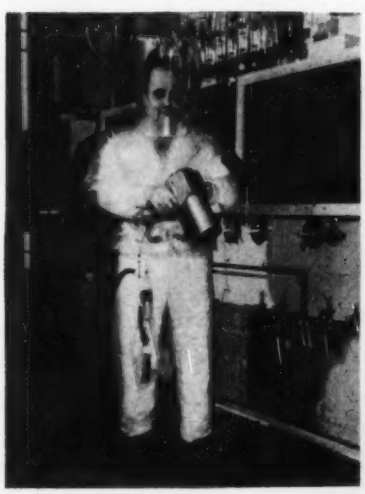
The suit is made in two pieces—trousers and hood. A set of large, thick vinyl bootees are electronically bonded to the legs of the trousers, and masking tape is conveniently strapped around the ankles to make the bootees fit all foot sizes yet still prevent the leakage of radioactive particles into the suit.

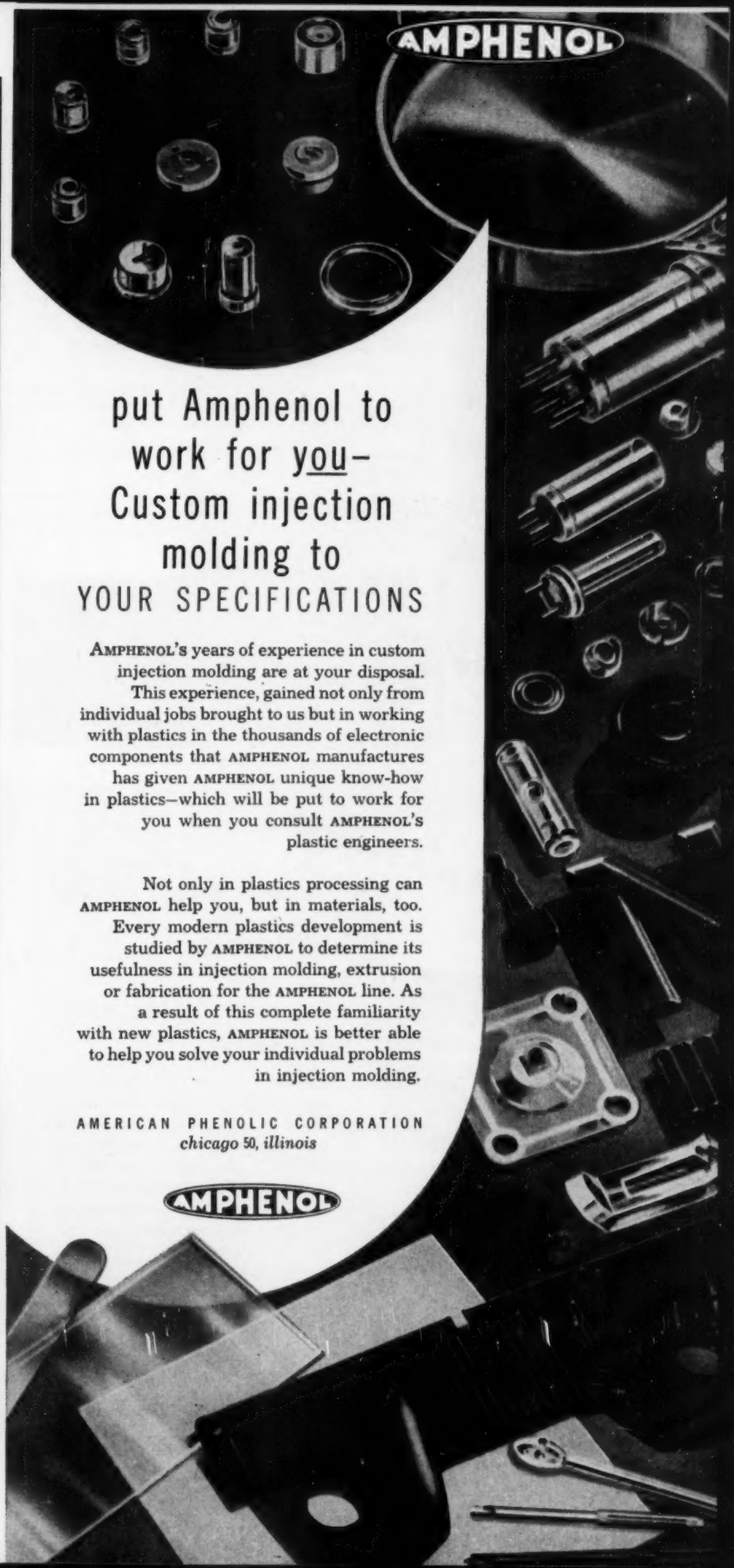
The hood, which includes a facepiece of stiff, transparent vinyl, is long enough to overlap the trousers at the waist. Rubber surgical gloves, attached with masking tape, complete the outfit.

Air for the scientist to breathe is supplied by an air hose through an inlet directly over the face piece. The cost of the suits in quantity lots is sufficiently low to allow them to be discarded after a single wearing.

CREDITS: Suits supplied by Dayton Safety Supply Co., Dayton, Ohio; development and fabrication by Snyder Mfg. Co., New Philadelphia, Ohio; Ultron vinyl film from Monsanto Chemical Co.

Vinyl suits and hoods protect atomic technicians against radiation

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Q. We *think* reinforced plastics may be useful in our product. How can we make sure?

A. Linzmeyer Development Laboratories will evaluate your application and tell you whether reinforced plastics will *perform better* or *cost less* than what you are presently using.

Q. Our staff doesn't know much about designing for reinforced plastics. Does Linzmeyer handle this too?

A. Indeed we do. Our engineers have designed a vast variety of reinforced plastics components and structures, including some of the largest and most complex ever molded.

Q. What about special problems of structural strength and electronic transmission?

A. These are right down our alley, too. We are completely equipped to do all the careful research and planning that will insure the satisfactory performance of the reinforced plastics we mold for you.

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Metal frame of tote basket is protected by coating of vinyl plastisol

Plastisol Coating

TOTE baskets to carry jet engine compressor blades through various processing stages at Utica Drop Forge & Tool Co., Clayville, N.Y., are protected against the corrosive effects of chemicals by being coated with a newly formulated vinyl plastisol.

At one manufacturing stage, baskets of blades go through a trichloroethylene de-greasing bath. The chemical will cause conventional galvanized coating to peel off the metal frame and dull the steel alloy blades. The corrosive trichloroethylene will even seep underneath ordinary plastisol coatings and break through the plastic, rendering the coating ineffectual.

As a solution to the problem, a special plastisol, 77X-1078, was devised which resists both trichloroethylene and perchloroethylene and has a hard, slick surface that facilitates rapid drain-off.

Before coating the basket, a primer, which is used to obtain maximum adhesion, is first applied to the unit by dipping. Two coats are laid on at 10-min. intervals, air dried for 30 min., and then baked for 10 min. at 400° F. While still hot, the basket is removed from the oven and immersed in the plastisol bath.

It is withdrawn after 20 to 30 sec. and cured for 30 min. at 385 to 400° F. into a tough, durable coating.

CREDITS: 77X-1078 plastisol formulated by The Stanley Chemical Co., East Berlin, Conn., from Geon resin supplied by B. F. Goodrich Chemical Co.

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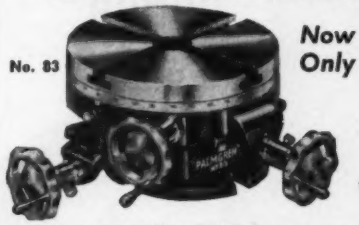

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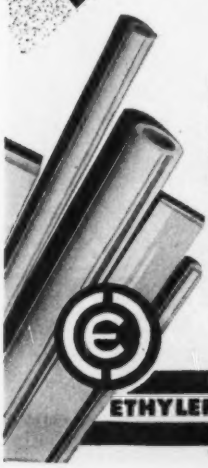

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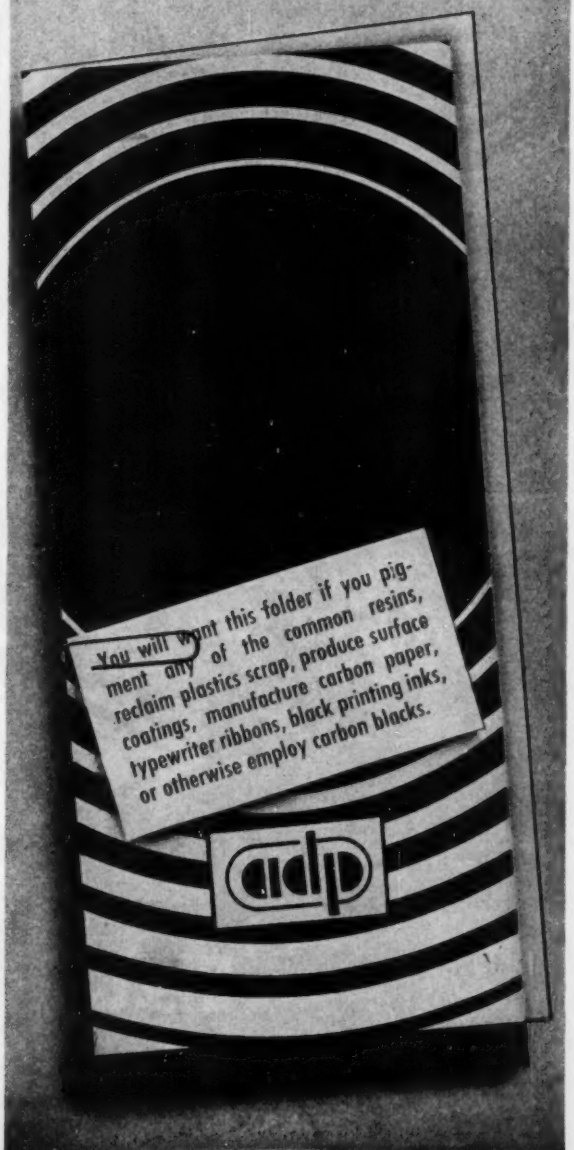
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Packaged Safety

TRANSPARENT, tough polyethylene bags open new possibilities in the packaging of safety equipment. As used by E. D. Bullard Co., San Francisco, Calif., the plastic bags represent a simple, practical, and functional package, suitable for a diverse range of equipment, from reinforced plastics helmets to safety belts and hoods.

Each bag has a round sealed bottom and an open top. To package a piece of equipment, the part is simply slipped into the bag and the top half of the bag folded under it.

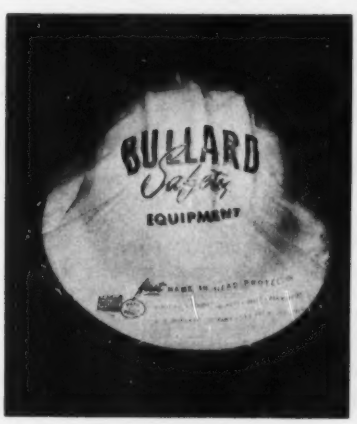
The advantages that accrue from the use of the new polyethylene package are threefold. First, since safety equipment is frequently purchased in large quantities, the packaged parts that have to be stored on factory shelves for long periods of time will remain in the same condition in which they left the factory.

Second, the polyethylene bags can be used for repackaging worn-out hats or caps that have been turned in for cleanings or repair.

Third, the polyethylene package provides an additional advertising source for the manufacturer of the safety equipment. Each package is printed with the name of the company, descriptive copy, and a trademark.

CREDITS: Safety equipment manufactured and packaged by E. D. Bullard Co., San Francisco, Calif.; printed polyethylene bags supplied by Mehl Mfg. Co., Div. Sydney Thomas Corp., Cincinnati, Ohio.

Printed polyethylene bag protects safety equipment while in storage



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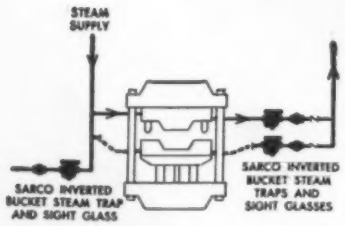
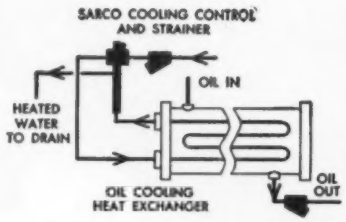
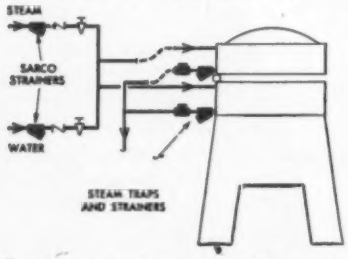


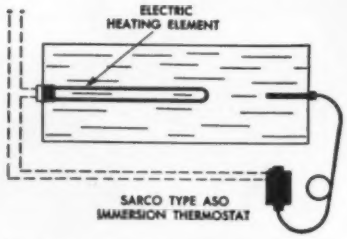
Compression molding press fitted with Sarco Inverted Bucket Steam Traps, the blast discharge of which scours the heating surface of the platens.



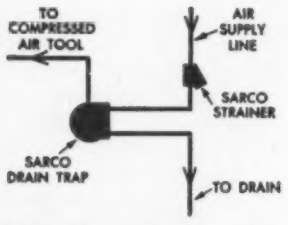
Heat exchanger cools hydraulic oil of plastics molding machines. Temperature of the cooling water is regulated by the Sarco Cooling Control.



Sarco steam traps on a steam-heated and water-cooled molding press.



Annealing bath temperature controlled by Sarco type ASO electric immersion thermostat.



Sarco Type F.A. trap draining small line to compressed air tool.

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New England S.P.I.

HIGHEST attendance in history was recorded at the Ninth Annual Meeting of the New England Section of The Society of the Plastics Industry, held at the Equinox House, Manchester, Vt., October 8 and 9. More than 375 people were present and convention sessions were exceptionally well attended.

The committee in charge of arrangements under E. W. Maass, American Optical Co. did an exceptionally smooth job of organization.

The opening session under the chairmanship of F. Reed Estabrook, Jr., Northern Industrial Chemical Co., featured three speakers. Hiram McCann, Editor of MODERN PLASTICS Magazine, keynoted the conference in his opening address "Where Do We Go From Here?". John DeBell, DeBell and Richardson, discussed recent developments in plastics raw materials with emphasis on the new principle of alloying and on greater versatility. R. W. Powell, The Hydraulic Press Manufacturing Co., reviewed new developments in equipment, particularly in injection machines for plastics.

The second-day conference session was under the chairmanship of Horace Gooch, Worcester Moulded Plastics Co. Again three speakers were featured. John J. O'Connell, Consolidated Molded Products Corp. and President of S.P.I., spoke on the topic "Management—What Are Our Weaknesses?". Dr. Lawrence M. Debing, Monsanto Chemical Co., discussed statistical quality control. Howard W. Lewis, Business Forms Corp., in his paper "Is Selling Plastics So Different?" pointed out that plastics, being relatively new, require stronger selling than other materials.

At the informal golf dinner, Arthur A. Staff, Koppers Co., Inc. and Robert S. Osborne, Bakelite Co. were in charge of operations.

Besides Mr. Maass, Mr. Estabrook, Mr. Staff, and Mr. Osborne, other members of the committee in charge of arrangements were: Winthrop Fleming, Standard Tool Co., R. W. Hubbs, The Harwid Co., R. A. Mazur, American Cyanamid Co., Otto Morningstar, Morningstar Corp., W. B. Wallace, Mack Molding Co., and George Whitehead, Improved Machinery Co.

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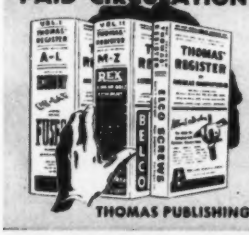

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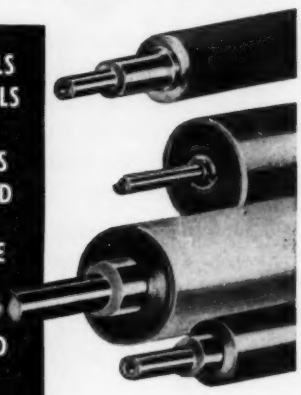

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Concept of Design

(*Continued from pp.* 90-91)

and a base molding. Also involved are some thirty minor plastics components. The weight of the largest of these plastics parts is 54.4 ounces. Design is simple in result but most complicated in detail because the whole job slips together by means of slots and bosses. Materials used are styrene alloy, cellulose acetate butyrate, vinyl, polyethylene, nylon, and phenolic.

Obviously, a secondary factor of this new trend in design for plastics is to make components as complicated as you like and to make the job difficult for the molder in order to have a simple job of assembly on the line and simple functional operation of the finished unit.

Third item is the Admiral Dehumidifier. It stands 23 in. high and is 16 in. in diameter. With the exception of the metal base, the handle, and the refrigerator system, it is entirely plastics.

Components include: Outer shell with molded-in louver, a three gallon drip pan, leg support covers, escutcheon, control knob, two interior rings, and switches. The outer shell is molded of styrene copolymer, weighs 61 oz., and is produced on a 1 min. cycle. The drip pan is transparent heat-resistant styrene. The rings are styrene alloy and the leg support covers are copolymer.

Longer on the market than any of the other three products featured here, and well into the millions in the quantity already produced, is the Herman Miller reinforced plastics chair designed by Charles Eames. The chair was deliberately designed for preform molding of the fibrous glass reinforced polyester resin, and the tools are high production steel dies. The chair body coming off the press requires no finishing. The metal legs, gasketed with rubber pads, are bonded to the chair body with epoxy resin. The product will take almost any kind of beating without harm. Market-wise it is a most economical proposition because little hand labor is involved either in construction or assembly.

In the next few years we shall see a broader and a more general application of this new design concept for plastics products with plastic components.—END

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BECAUSE . . . Marvels (Both Sump and Line Type) operate at full efficiency in any position. Line type may be serviced without disturbing pipe connections.

BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration.

BECAUSE . . . Marvel not only delivers a top grade filter in both quality and performance, but delivers IMMEDIATELY—shipments are made the same day as orders are received, if desired.

BECAUSE . . . Marvels (Both Sump and Line Type) are available in individual capacities from 5 to 100 G.P.M. and choice of mesh sizes ranging from coarse 30 to very fine 200, they get a filter to fit their specific requirements.

LINE TYPE (Cutaway)

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OVER 400 MANUFACTURERS MAKE MARVEL SYNCLINAL FILTERS THEIR O.E.M. CHOICE

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Name .....

Company .....

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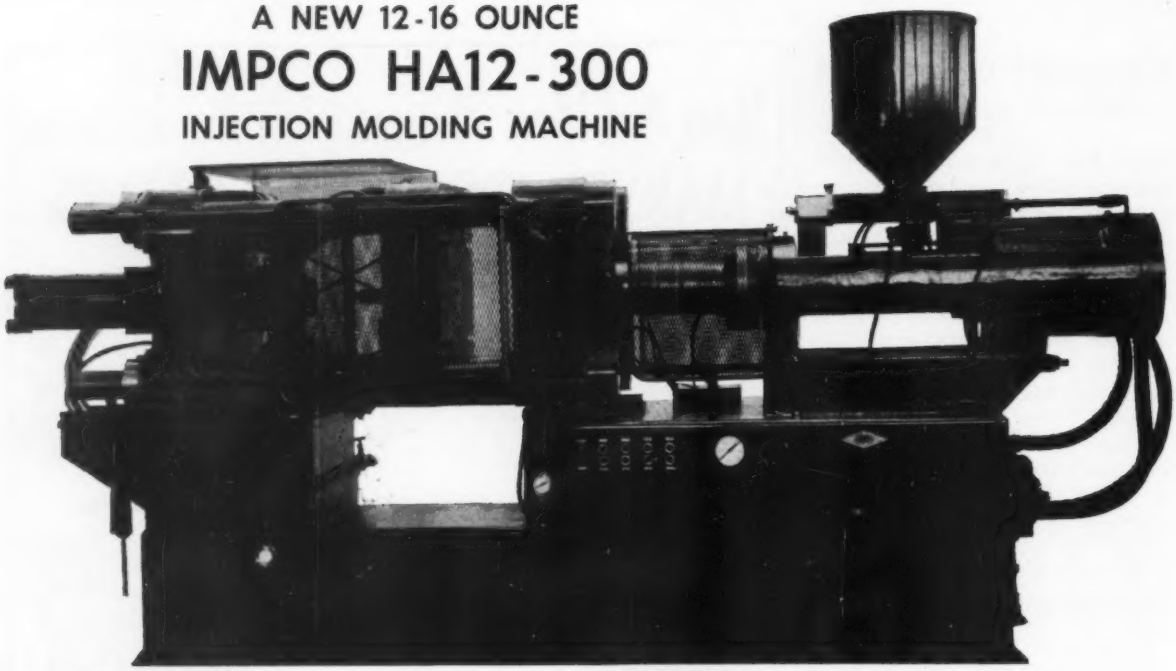
IMPCO HA12-300

INJECTION MOLDING MACHINE



SPECIFICATIONS:

Injection Capacity—12 Ounces
Injection Pressure (Plunger)—22,400 lbs. p.s.i.
Clamping Pressure—300 Tons Stroke—12½"
Mold Space (Between Tie Rods)—16" x 19¼"
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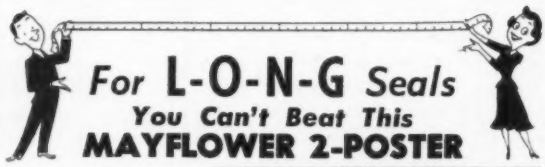

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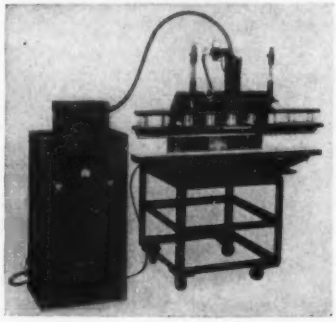

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Corvette

(*Continued from pp.* 83-91)

ing and design freedom are particularly important, it lends itself ideally to reinforced plastics construction. Through the Corvette program, Chevrolet engineers expect to learn a great deal about how this material can be handled on a production basis and whether it might be profitably utilized for certain body parts or panels of regular production models.

Since the output of the present car is limited, no great economies are seen until operations are transferred to St. Louis, where production of up to 50 Corvettes daily will justify rearrangement and greater efficiency in assembly operations. Many of the ultimate production answers will not be forthcoming until matched metal die processes have been thoroughly tested. At present, limiting factors include lack of experience, costs of hand labor, and low volume production in parts. Production times are still in transition, and such factors as the number of molds required and other production details continue to be studied.

Presumably, the large underbody section, which now requires roughly 4 hr. for fabrication, can eventually be produced in 20 minutes. No doubt, costs can be reduced as volume increases. However, there is a definite need for lower cost, more durable dies and faster curing polyester resins.

From the design standpoint, it is interesting to note that the Corvette is not a racing car but is intended to satisfy the American public's conception of beauty, comfort, and convenience, plus performance—a sports car built in the American tradition. Seating two persons comfortably, and beautifully finished throughout, the Corvette is powered by a six-cylinder valve-in-head engine equipped with three carburetors and developing 150 hp. at 4200 r.p.m. This is coupled with a Powerglide automatic transmission modified to provide full throttle upshift at 55 m.p.h.

CREDITS: Molding of body sections for Corvette, Morrison Reinforced Plastics, Ashtabula, Ohio. Polyester resins, various suppliers, in conformity with Chevrolet specifications. Cast phenolic and epoxy-fibrous glass molds, Plastics Div., Creative Industries of Detroit, Detroit 34, Mich.

— SAYS MR. DICK BURNHAM of B. W. Molded Products Company, Pasadena, California.

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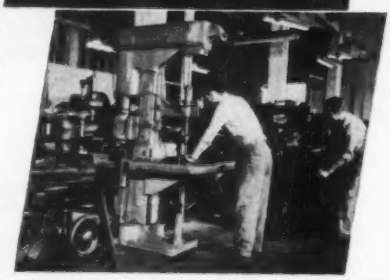

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Adhesives

(*Continued from pp.* 93-96)

dux, is being utilized extensively in the English aircraft industry as a replacement for riveting and welding. Liquid phenolic is first coated onto the metal and a thermoplastic vinyl powder is sprinkled on top of it. The assembly is cured under heat and pressures, which range from 10 to 250 p.s.i., to effect a strong, serviceable bond.

Two other popular metal-to-metal adhesive types are those derived from silicone and furan-derivative resins.

The silicones provide excellent temperatures and electrical properties. For optimum results, they require special treatment of the metal surface before application. Also, to develop full strength, the silicones require curing at temperatures that often reach 400 to 450° F.

The furan-derivative resin adhesives have been reported to provide excellent waterproof bonds. As a general rule, acid catalysts must be added to the adhesive formulation prior to use.

New Adhesives

Characteristic of the metal-to-metal bonding adhesives within the past few years has been the development of new and improved adhesives with more advantageous properties.

One of the most important of these new developments has been the epoxy resins. Although epoxy resin adhesives are only a few years old, it is widely predicted that the epoxies will exceed the phenolics in sales volume by next year.

The epoxies are moving up so strongly in metal-to-metal bonding applications because of their unique adhesive qualities. Some experimental modifications retain up to 85% of their strength at 500° F.; by a judicious selection of catalysts, usually amines, bonds may be cured at room temperatures with only contact pressure necessary, although elevated temperatures during cure appear to give stronger bonds; and no volatiles are released during the curing step.

The epoxy resins which are used as the basis for these adhesive formulations are of the multi-epoxy type, such as would be produced

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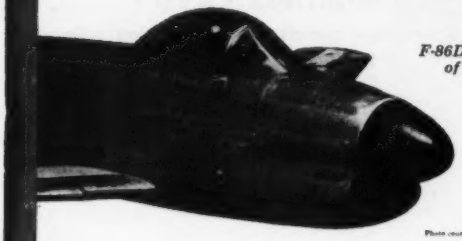

The radome on the F-86D Sabre Jet is but one of countless production parts fabricated of Hexcel Honeycomb.

Photo courtesy of North American Aviation Company

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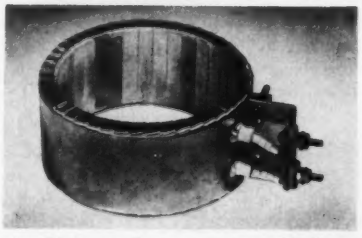

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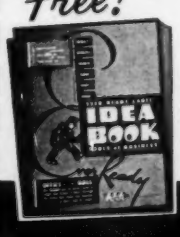

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by the polymerization of epichlorohydrin and bisphenol-A. The ether and carbon-carbon linkages that are thus formed in the chain structure impart extremely high chemical resistance. The chain which cross-links on curing remains relatively flexible because of the wide spacing between the hydroxyl and epoxide groups. Extremely good adhesion results from the high polarity of the molecules. Alkaline catalysts, such as triethylamine, generally give better results with the epoxy adhesives than do acid catalysts.

At the present time considerable work is being done on epoxy resin adhesives to produce an even better product than is currently available. Early adhesives were lacking in peel strength and flexibility, but the new fillers and activators that have been developed are expected to remedy this shortcoming within a short time.

Polyurethane Resins

Another metal-to-metal adhesive which is gaining in popularity is based on polyurethane resins. Work on polyester and isocyanate resins was initiated in Germany in 1935.

Monsanto Chemical Co., Springfield, Mass., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and Armour & Co., Adhesives Div., Chicago, Ill., are presently developing polyurethane adhesives in this country.

The advantages to be obtained from the adhesives based on polyurethane resins include good bond strength, good low temperature flexibility, and excellent water resistance. The adhesives can also be prepared so that curing at room temperatures is possible.

Stability of the prepared adhesives is limited largely by the extent to which moisture is present during storage and also by the tendency of the prepared adhesive to cross-link inside a closed container. The latter factor can, of course, be varied by the choice of raw materials which are used in preparing the adhesive.

The Future

Since World War II, a great deal of attention has been directed towards the development and evaluation of adhesives for metals. Creep, shear, tension, and impact tests, the effects of weathering, chemical re-

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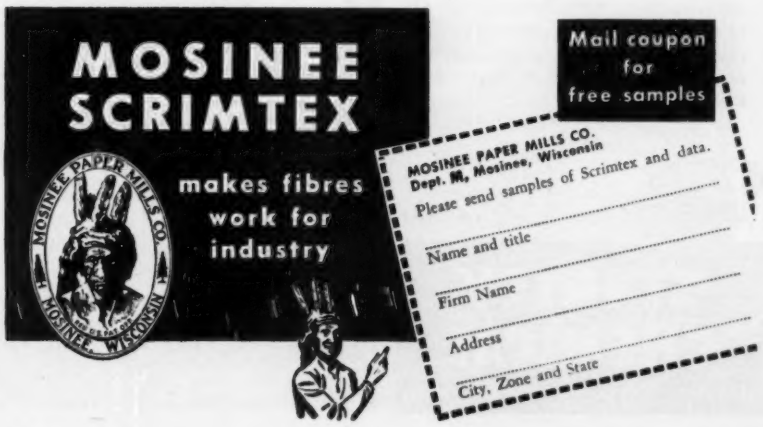
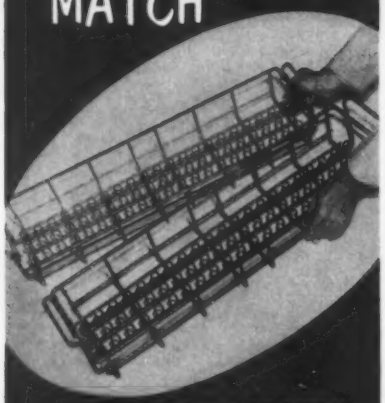


Trichlorethylene MEETS its MATCH



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sistance—all these properties have been investigated and evaluated in terms of performance of the bonded assembly. There is much work still to be done in this field, however, including the development of adequate non-destructive tests for inspecting the completed bonds.

Another important consideration that has arisen in recent years is the effect of elevated temperatures on metal-to-metal adhesives. Aircraft and missiles are being designed and built to attain ever-increasing air speeds.

Such aircraft demand more rigid temperature requirements on the structural adhesive joints, and a great deal of today's research effort is directed towards a solution of this problem.

A number of experimental elevated temperature-resistant adhesives have already been developed to meet strength requirements at temperatures of 500 to 600° F., and recently, the first supersonic jet fighter-bomber with primary structural bonding by epoxy resin was flown successfully in France. While these adhesives are designed primarily for aircraft use, it is quite likely that they will be employed readily in other industries where certain constructions might require similar strength characteristics at similar temperature ranges.

On the other side of the temperature scale, synthetic resin metal-to-metal adhesives are finding increasing use in applications involving low-temperature requirements. Because of these synthetic adhesives, thin metal sheets can now be successfully used at temperatures as low as −250° F. One company predicts that in about six months, these adhesives will go into wide use in the refrigerator business in the bonding of freezer coils to freezer sheets.

Thus, the future for the metal-to-metal synthetic resin adhesives looms larger and larger. There are several obstacles still to be overcome, such as a simpler method for cleaning the metal before bonding, but as soon as these limitations are eliminated—and the prospects for this eventuality are good—the adhesives are certain to become one of the most important and profitable tools that has been placed in the hands of the metal working industries.—END

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Mr. W. F. Haverkamp, Chemical Engineer of Columbia Wax Co., Glendale, California, reports variable speed Speed-Trols driving blending agitators eliminated the need for belt and supplementary gear systems, increased production capacity of equipment by greatly reducing processing time, and improved product quality. In over two years the only maintenance has been periodic lubrication.

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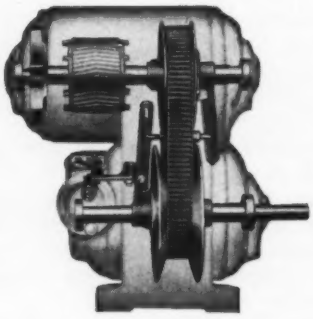

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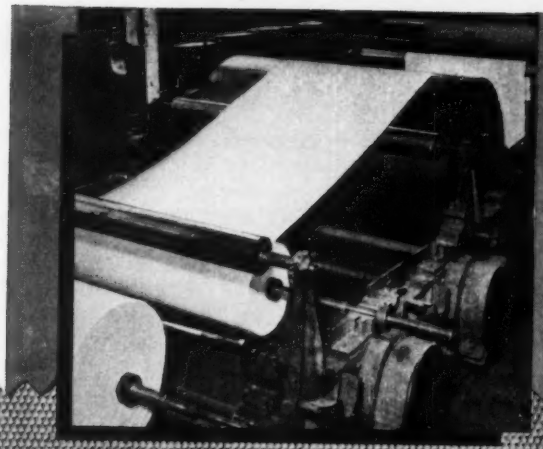

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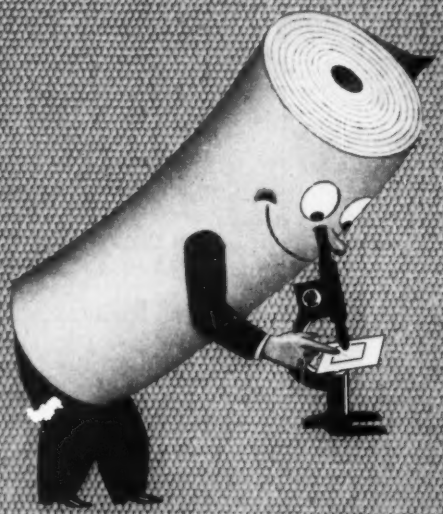

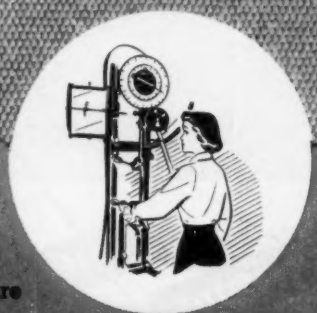

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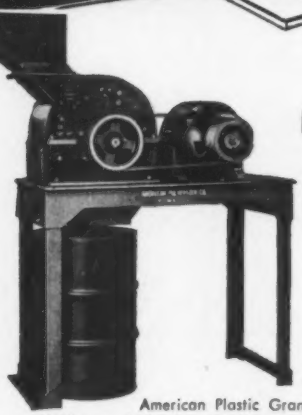

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Small but Mighty

(*Continued from p.* 104)

Crest radio are produced in a two-cavity die in a straight compression press. Electronically preheated preforms are used to expedite the molding operation. From the molding standpoint, a rather unusual feature is the fact that the mold is mounted in the press with the cavity at the top and the core at the bottom. In loading the mold, the preforms are placed on the punches. This arrangement prevents flash or loose powder from becoming lodged in the cavities and also facilitates removal of the parts, since the case halves remain on the punches when the press opens.

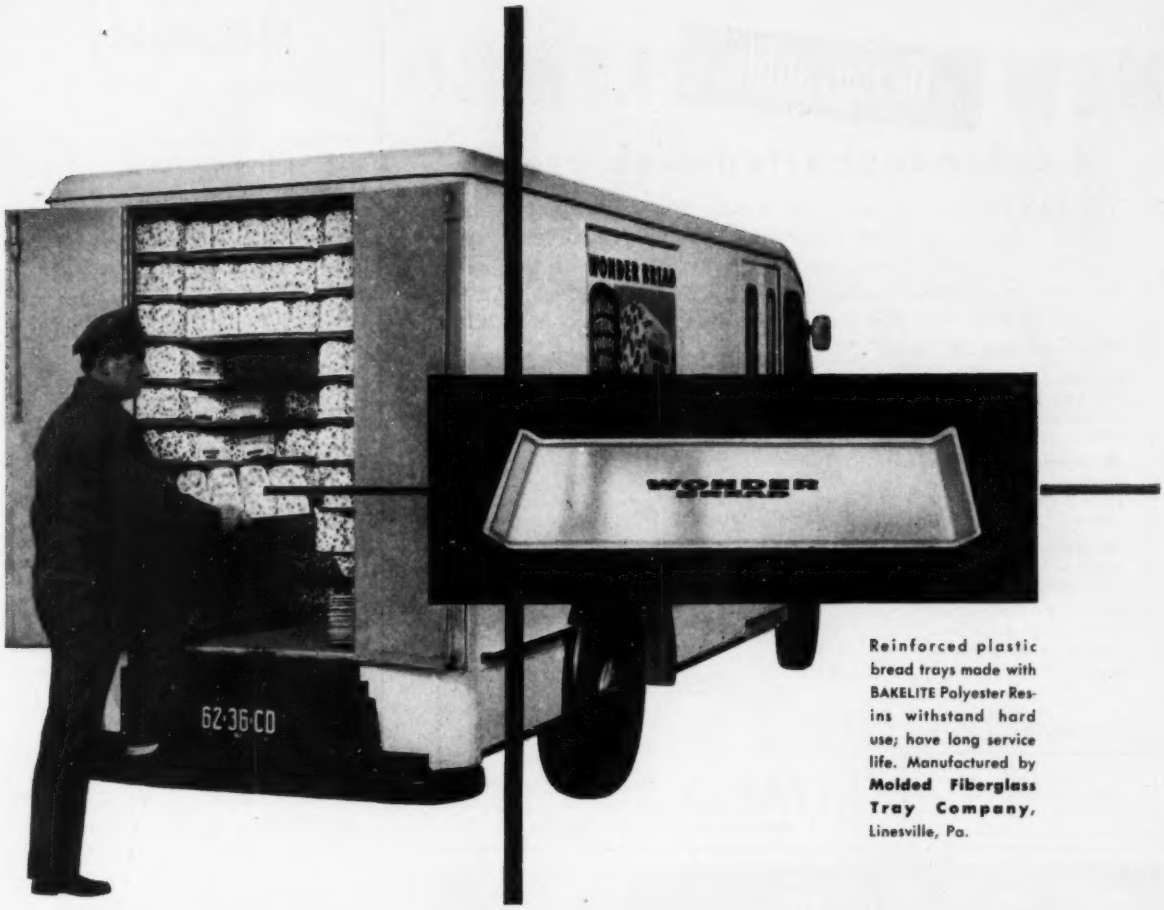
Upon removal from the press, the parts are immediately placed on cast aluminum shrink fixtures to insure against warpage. The fixture for the front half of the cabinet is equipped with a deflashing unit which quickly punches out the thin flash in the circular grille. The deep ribs of the grille (see cut-away view, p. 104) make it particularly important that this deflashing operation be handled efficiently.

Molded-in Features

Cored bosses for mounting of chassis and speaker, openings for the control shafts, and provision for mounting the plug-in connection at the back of the set are among the molded-in features of the cabinet halves. The top of each half also has two internal projecting ribs which insure even alignment across the top joint when the parts are assembled. The back section has a series of eight ventilating holes which are concealed by the handle in its lowered position.

The handle-type antenna housing is injection molded of styrene. On its open under side are two cored bosses by means of which the iron core antenna is mounted with thread-cutting screws. The decorative metal crest which serves as an identifying mark of this set is mounted through the center of the grille by means of two lugs projecting from the back.

CREDITS: The case components of the Zenith Crest are molded by General Die Mold Co., Chicago, Ill. The handle is produced by Breyer Molding Co., Chicago, Ill.



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...by REINFORCED glass fiber plastic tray

More and more bakeries are profiting from faster, easier, less costly deliveries thanks to a new bread handling system. The key to it is a reinforced glass fiber plastic tray made with BAKELITE Polyester Resins. This tray makes truck loading easier and faster . . . loading time can be cut to a fraction of what it was! Salesmen can make deliveries in less time . . . with less effort. And they deliver *better looking* bread, for with these trays bread is handled only *once* from wrapping machine to store shelves. Bread isn't crushed out of shape! Wrappers stay smooth and glossy—keep their eye-appeal!

The tray, made by Molded Fiberglass Tray Company, is light in weight, moisture-resistant, strong . . . stronger than steel on a weight-strength basis! Its shape allows space-saving nesting of "empties" in delivery truck and bakery. Smooth surfaces won't snag wrappers . . . are easily cleaned, thus reducing maintenance to a minimum. Colors and printing can be molded into the tray.

In a typical tray system, 10 or 12 loaves—depending on size—are slid on a tray after wrapping. Loaded trays go by conveyor or cooling racks to the loading platform where they are placed on angle irons in the trucks. The salesman carries loaded trays from the front of his truck right into the store to make delivery!

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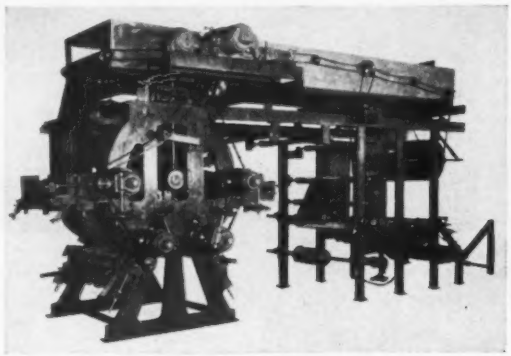

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Metallizing

(*Continued from pp.* 122-123)

necessary to discard the vessels after each operation of the unit. However, cost of the crucibles is a relatively minor portion of the entire expense. Consumption of aluminum is less than ½ lb. per 1500-ft. roll of material.

The cost of aluminizing acetate sheet, including labor charges, runs approximately 5 to 6¢ per sq. foot.

Transfer Film Production

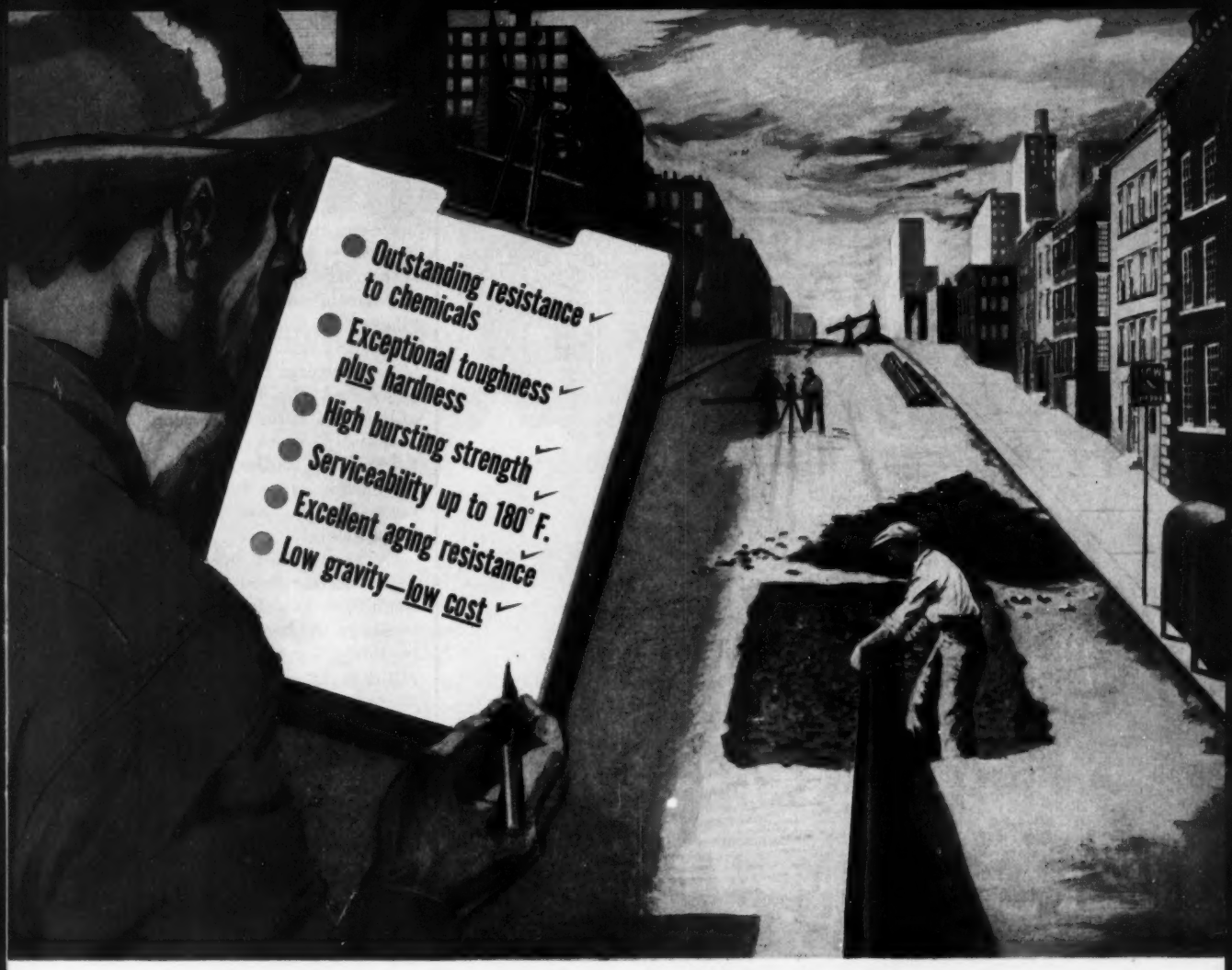
In the preparation of transfer material, the metallization phase of the process is essentially the same as for the acetate or polystyrene mentioned above. However, the sheet preparation step is quite different in that a wax material, which will melt when heat is applied, must be added prior to metallization. This wax serves to release the metal film from the plastic base, thus making the transfer possible.

The wax must flow on the base material readily and harden with a brilliant surface to insure that the evaporated metal is bright in appearance. Also, it must not outgas appreciably when processed in the vacuum chamber. Of course, its melting point must be low enough to permit transfer without the plastic base flowing. High purity beeswax was commonly used for this.

The final step in the preparation of the transfer material is the coating of the metallized plastic with a bonding agent or cement. This cement is essential to bond the metal film to the receiving object. It must be somewhat heat sensitive and must not contain solvents which would attack the metal film or the wax release material.

Transfer materials of gold, silver, and aluminum are currently being marketed for such applications as book lettering, metal coating of shoe leather or synthetic shoe materials, metal coating of cloth (a substantial use is currently being made of this for fire-fighting clothing), etc.

Companies using the high vacuum metallizing process to produce transfer material are: Peacock Roll Leaf Co., Brooklyn, N.Y.; M. Swift and Sons, Inc., Hartford, Conn.; Hastings & Co., Philadelphia, Pa.; and Metallized Products Inc., Norwalk, Conn.—END.



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Chair Bases

(*Continued from pp.* 116-118)

the cavity mounted on the head of the press. Before the preform is loaded in the mold, a predetermined amount of pigmented and catalyzed resin mixed with filler is poured into the female side of the preform and allowed to penetrate and sink into the glass fibers.

The preform is then turned over and placed (Fig. 4) on the force plug of the mold. After the mold is closed, pressure of approximately 90 tons is applied. The total curing time is less than 2 min., after which the mold is opened and the part removed (Fig. 5).

Only one more operation is required on the chair base before assembly. A hole is machined in the center of the base to proper size for mounting a metal bushing. Because of the design of the inside section of the outer end of each leg of the base, the assembly of the casters is greatly simplified. Only 16 sec. are required to fasten the four casters in position.

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The finished chair base is ¾ lb. lighter than the same base in aluminum and over 4 lb. lighter than a similar base in steel. No refinishing will ever be required and to prove this Sturgis cites the following evidence:

This chair base made its first public appearance at a National Stationery and Office Equipment Show. A box of sand was placed beside the chair base and visitors were requested to step in the sand and then scrape their feet across the surface of the base. Over 2000 people did this during the show. Sturgis states that with one application of clean water and then one of neutral shoe polish, all scuff marks disappeared completely, leaving no evidence of the abuse the base had taken.

An unusual feature of the chair base is its self-leveling performance. The flex characteristics of the base are such that regardless of the unevenness of the floor, the weight of the occupant keeps all four casters in contact with the floor. In addition, the distinctive pattern of the glass fibers is capitalized upon to introduce a new decorative note in office chair bases.—END.

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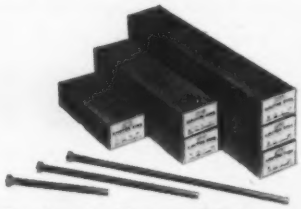

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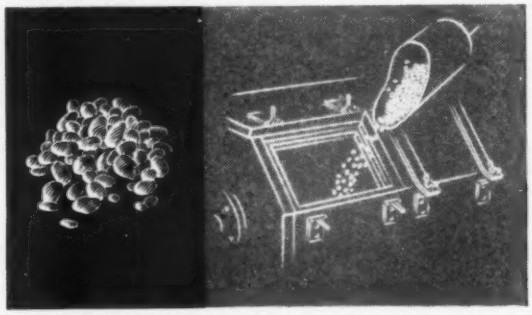

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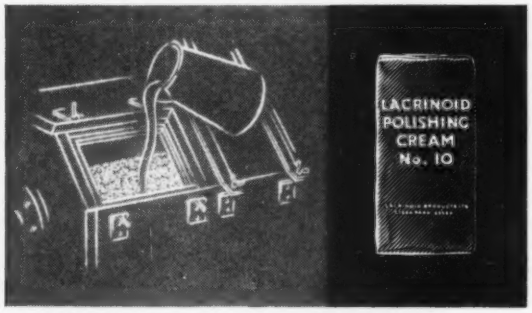

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Filled Plastics

(*Continued from pp.* 125-132)

materials on January 1, 1952, the time when this study was being made. Assuming fibrous glass and plastic at 40¢ per pound, and inorganic filler at 1½¢ per pound, Table III shows the average savings that can be obtained by the use of 70% filler-30% plastic compositions.

Unfilled plastics reinforced with 22% glass by volume have a materials cost of 40¢ per pound. By substituting a 70% filler-30% plastics mix for the unfilled plastic, the materials cost can be reduced from 40 to 20¢ per pound, a saving of 50 percent. However, since reinforced plastics are sold on a volume basis rather than by the pound, the materials cost saving is in reality lower due to the higher specific gravity of the 70% filler-30% plastics mix. A pound of material of this composition occupies a smaller volume than a pound of an unfilled plastic.

A more accurate comparison is effected by comparing the materials costs of equal volumes of reinforced plastics. For instance, Table III shows that an unfilled plastic reinforced with 22% glass by volume has a materials cost of 2.3¢ per cubic inch. By substituting a 70% filler-30% plastics mix for unfilled plastic, the materials costs can be reduced from 2.3 to 1.5¢ per cu. in., a savings of 0.8¢ per cu. in. of laminate or 35 percent.

Materials cost should not be used as the only criterion for selecting or rejecting a particular formation. Materials cost should be correlated with product properties. As shown in Table IV, laminates may have the same range of materials cost but widely different product properties. By doubling the glass content from 11 to 22% by volume, the flexural strength can be increased 46%, whereas the materials cost is increased only 15 percent. This point can be illustrated further by the comparison of an unfilled plastics laminate reinforced with 22% glass by volume with a laminate containing a 70% filler-30% plastics matrix and reinforced with 11% glass by volume. By cutting the glass content 50% and substituting a 70% filler-30% plastics mix for the unfilled plastic, a reduction of only 8% in flexural strength occurs, whereas the materials cost is reduced 43 percent.

A correlation of physical properties with materials cost can become very complicated. However, if the materials cost per unit volume is divided by the strength of the laminate, a value results which permits direct comparison. Table IV shows the materials cost per cubic inch of

(*Continued on p.* 219)

Table III—Effect of High Inorganic Filler Concentrations on The Materials Cost of Fibrous Glass Reinforced Plastics Laminates

Composition of laminate				
	Matrix			
Fibrous glass	*Plastic*	*Inorganic filler*	*Materials cost*	
% by vol.	*% by wt.*	*% by wt.*	*¢/lb.*	*¢/cu. in.*
11	100	0	40	2.1
11	30	70	17	1.3
22	100	0	40	2.3
22	30	70	20	1.5

Table IV—Correlation of Materials Cost With Physical Properties of Fibrous Glass Reinforced Plastics Laminates

Composition of laminate					
	Matrix				
Fibrous glass	*Plastic*	*Inorganic filler*	*Flexural strength*	*Materials cost*	
% by vol.	*% by wt.*	*% by wt.*	*10^3 p. s. i*	*¢/cu in.*	*¢/cu. in./1000 p. s. i. flexural strength*
11	100	0	19	2.1	0.111
11	30	70	24	1.3	0.054
22	100	0	26	2.3	0.088
22	30	70	35	1.5	0.043

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laminate in cents per 1,000 p.s.i. flexural strength. The comparative data indicate that the higher the fibrous glass and inorganic filler content in a laminate, the lower the materials cost per unit strength. Doubling the fibrous glass content in a laminate reduces the materials cost per unit flexural strength 22 percent. By doubling the fibrous glass content and by substituting a 70% filler-30% plastic mix for unfilled plastic, a reduction of 61% in materials costs per unit flexural strength can be effected.

Cost comparisons presented are confined to materials. It is not the purpose of this paper to evaluate comparative processing economics.

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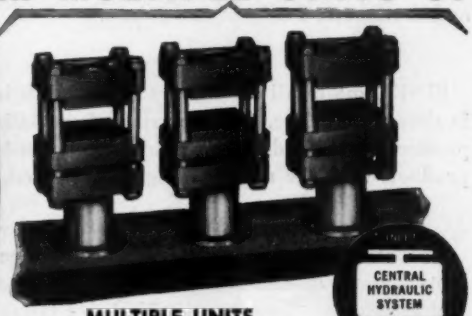

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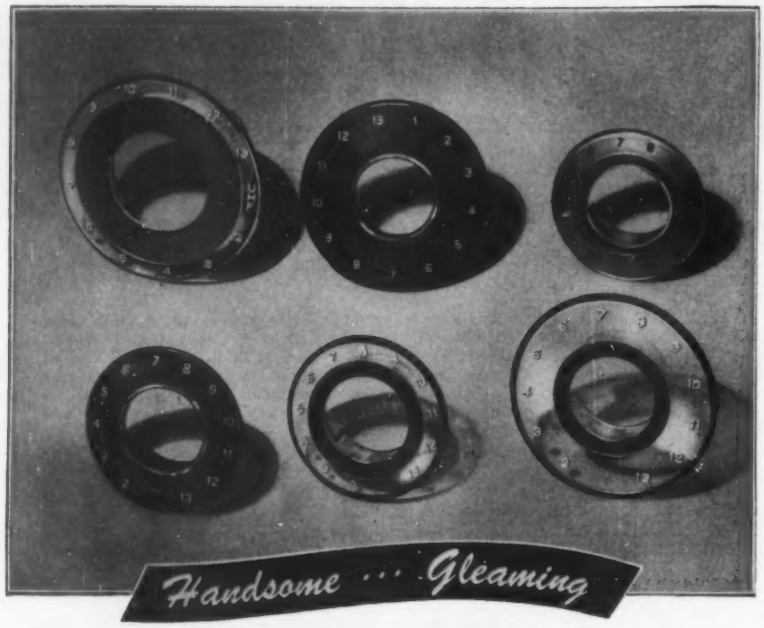

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Modified Resins

(*Continued from pp.* 136-140)

densation products are reacted with excess epoxide, it is probable that the excess does not contribute exclusively to lengthening the side chain since no highly ionized group is present to exert a strong directive effect. Acetylation data for products of the reaction support this belief.

The ability of high mol-ratio phenol-formaldehyde resins to thermoset decreases with increasing amounts of epoxide modification, and disappears completely when phenolic groups are no longer present. Rockwell hardness values (H scale) of castings produced from phenol-formaldehyde condensation products modified with glycidyl phenyl ether in Table II, p. 140, illustrate this. These castings were prepared by acidifying the previously modified system to a pH of 4.5 with lactic acid, dehydrating at 90° C. and 30 mm. pressure to constant weight, pouring into molds, and curing.

Epoxide modified resorcinol-formaldehyde condensation products lose their ability to gel when the phenolic groups are completely converted, as shown in Table III, p. 140.

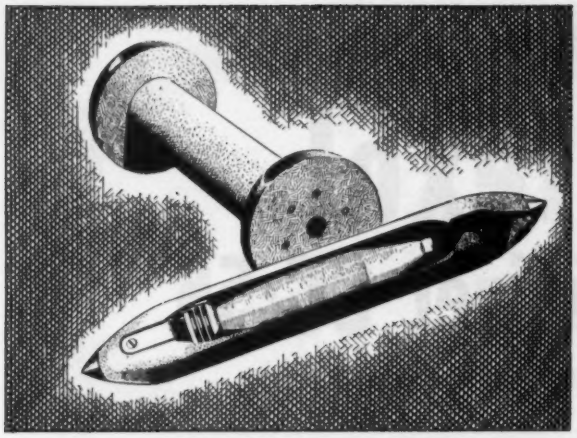
Ethylene oxide modified phenol-formaldehyde (mol ratio 1:2.32) condensation products act similarly.

A series of such modifications (0.0, 0.5, 1.0, 1.35 mols of ethylene oxide per mol of phenol) ranged from a ruby red solution of pH 7.6 (0.0) through an orange solution of pH 8.6 (1.0) to a pale yellow solution of pH 8.7 (1.35). Benzyl trimethyl ammonium hydroxide was employed as the catalyst in the initial condensation. Reinforced fibrous glass tapes impregnated with these, air-dried, and baked 5 min. at 175° C. were red and brittle (0.0), or almost colorless and flexible (1.35).

A second series (0.0, 0.81, 1.87, 2.43, 3.18 mols) extended from a red-brown solution (0.0) to an almost water-white solution (3.18). These, in thin layers, upon dehydration to constant weight in a vacuum oven at 85° C. formed products ranging from a hard film (0.0) to a liquid (3.18).

Another series (1.06, 1.61, 2.28, 2.99, 4.10, 5.19, 5.90 mols) acidified to a pH of 4.5 and then dehydrated extended from a soft sticky film (1.06) to a liquid (5.90).

The modified resins that contain



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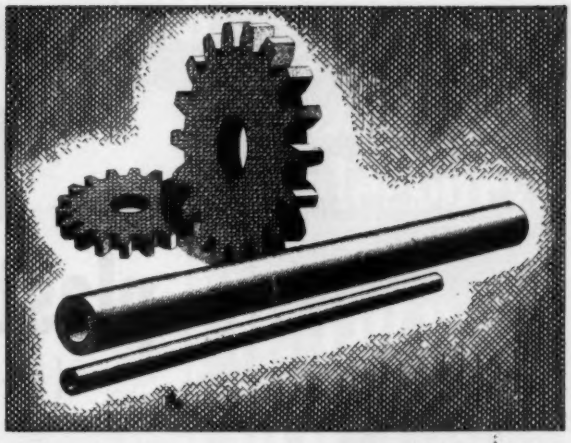

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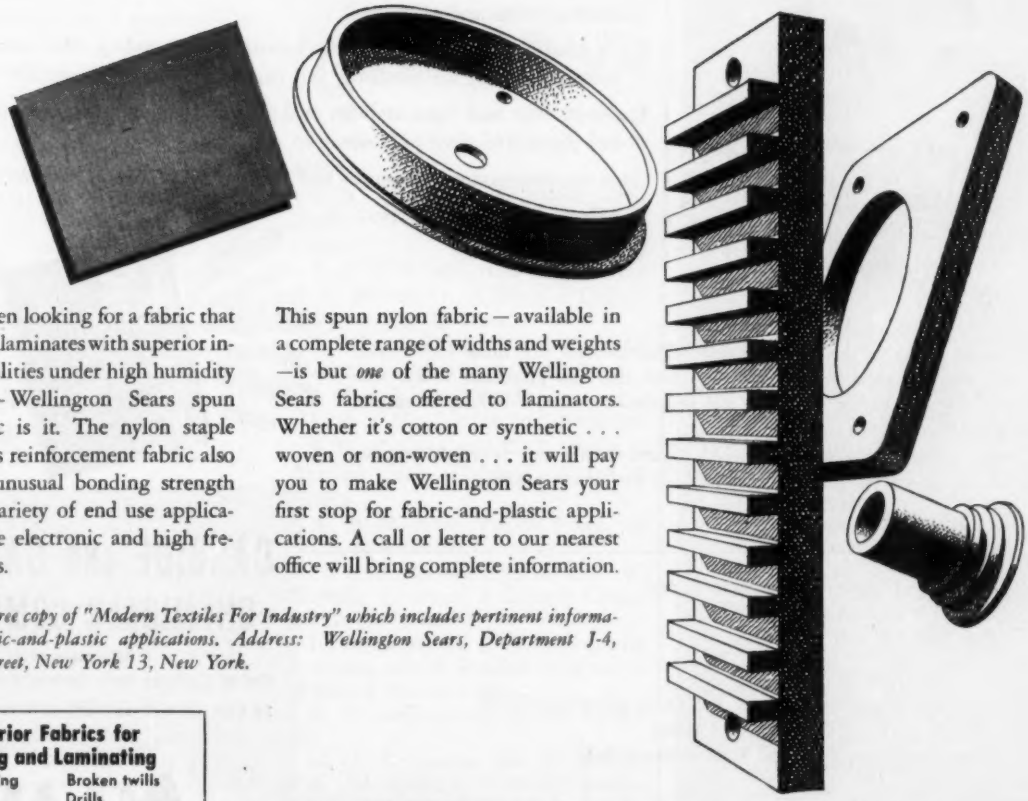

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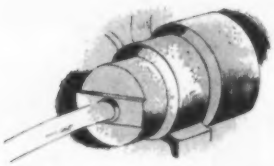

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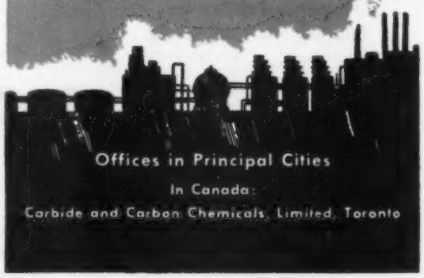

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Table IV—Preparation of Acetate Esters of Phenol-Formaldehyde Resins Modified With Ethylene Oxide

Condensation product		*Epoxide modification*		*Acetylation*		
Formaldehyde per mol phenol	*Condensation time at reflux*	*Epoxide per mol phenol*	*Yield of dehydrated resin per g. of phenol*	*Acetic anhydride per mol phenol*	*Yield of acetate*	*Acetyl value*
mol	*min.*	*mol*	*g.*	*mol*	*g.*	
2.32	24	1.5	2.39	6.00	3.59	2.7
2.32	24	4.5	3.87	10.00	5.40	3.4
1.80	31	1.5	2.19	6.00	3.25	2.4
1.80	31	3.0	2.94	6.00	4.20	2.8
1.80	31	4.5	3.81	0.75	4.20	0.9
1.80	31	4.5	3.81	1.50	4.54	1.6
1.80	31	4.5	3.81	2.25	4.72	2.0
1.80	31	4.5	3.81	3.00	4.96	2.6
1.80	31	4.5	3.81	3.75	5.25	3.2
1.80	31	4.5	3.81	4.50	5.23	3.2
1.30	43	1.5	2.07	6.00	3.01	2.1
1.30	43	3.0	2.84	6.00	4.05	2.7
1.30	43	4.5	3.72	6.00	5.40	3.8

no free phenolic groups are thermoplastic. They possess polyhydric alcohol type structures and are capable of further reaction through these alcohol groups.

A number of acetate esters of the phenol-formaldehyde condensation products modified with ethylene oxide, have been prepared and studied (Table IV). Acetylation is carried out by mixing a quantity of the dehydrated modified product (containing one mol of phenol initially) with acetic anhydride, refluxing this mix for 30 min., removing volatile material at 135° C. and 30 mm. pressure, dissolving the residue in acetone, neutralizing with sodium carbonate, filtering, and again connecting to the vacuum system to remove acetone. The increase in weight is attributed to the addition of acetyl groups and is the basis for calculation of acetyl values.

These acetate esters exhibit the properties of plasticizers for cellulosic plastics. They have good compatibility with both cellulose acetate (Hercules LL1) and cellulose acetate propionate (Eastman 331-2). Aging studies of these systems at 90° C. show good retention of the plasticizer. Esters of these polyhydric alcohols with other acids, including mixed acids, drying oil fatty acids, and dibasic acids, have also been prepared and given preliminary study.

Acknowledgment & References

This research was sponsored by the Catalin Corp. of America which has applied for patents based upon its results. The authors are also grateful to Messrs. H. E. Collier and G. J. Frisone for assistance in the experimental work.

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. VAN BOSKIRK

Broadening the Base

PURCHASE of the Plaskon Div. of Libbey-Owens-Ford Glass Co. by Allied Chemical & Dye Corp.'s Barrett Div., 40 Rector St., New York 6, N. Y., has more significance to the plastics industry than has been generally recognized. The new acquisition by Allied gives that corporation control of an established plastics producer and thereby a substantial base upon which to build an expanding plastics domain that eventually will result in Allied's production and sale of almost all the principal plastics materials known to the industry.

Barrett Div. of Allied Chemical will operate the Plaskon organization and maintain the plant with substantially the same personnel in Toledo, Ohio. William W. Knight, Jr., Plaskon's former chief, has been appointed a vice president of Barrett. Carleton Ellis, Jr. remains as sales director and Henry DeVore will continue to handle molding powder, the same as under the old Plaskon administration. Sam Gurley, Jr., who was formerly manager of resin sales of Barrett, has moved from New York to Toledo to become the general sales manager. At the time of going to press, arrangements for the new alignment of other personnel had not been completed.

The various sales departments of Barrett Div. are now as follows: Building Materials; Chemicals; Paving and Construction Materials; Industrial Solvents; Creosote and Pitch; Benzol Tank Wagon Stations; Protective Coatings (coal-tar enamels used largely for pipe lines); and the Plastics and Resins Dept. which will absorb Plaskon in addition to handling sales of urea and phenolic resins now produced at Philadelphia and Greensboro. The name Plaskon will henceforth be used only as a trade mark for materials sold by the Plastics and Resins Dept. of Barrett Div., Allied Chemical & Dye Corp.

There are at present three sales groups, with a fourth projected, in the Plastics and Resins Dept. One is the molding compound group which will sell urea, melamine, and alkyd-filled compounds. It is also probable that a phenolic molding powder will be sold by this group within a year. Up to now, Barrett has sold phenolic resin only to those who wished to make a compound. The alkyd compounds may be either asbestos- or glass-filled. The glass is used where especially high impact resistance is needed and good electrical properties must be maintained. These mineral-filled alkyds, an innovation by Plaskon, are now reported to be moving into the automotive field for such applications as coil tops, spark plug connectors, terminal blocks that have replaced ceramics, and window switch receptacles. One Plaskon customer molder has made one million television tuners of molded alkyd.

A second sales group of the Plastics and Resins Dept. will handle coating resins. Urea, phenolic, alkyd, melamine, modifications of each, and modified oil, rosin, maleic, and silicone materials will be in this group's inventory.

The third group will distribute industrial resins, such as urea for adhesives, textile finishing, and paper treatment; foundry core binders made from urea, alkyd, or phenolics; and miscellaneous binder resins such as those used for laminating, mineral wool insulation, shell molding, brake linings, abrasives, adhesives, and in oil well mud. Phenolic Novolak resin which is sold to customers who make their own molding compound is also handled by this group. This third group will also sell polyester resins of both the styrene and diallyl type, as well as a chlorinated high heat-resistant variety.

Another group, projected for some time in the near future, will be designated as the thermoplastics group. Its first product will be polyvinyl chloride resins. The corporation now has a vinyl chloride pilot plant in operation and expects to have commercial production within a reasonable length of time.

It should also be noted that Barrett is engaged in the manufacture of Cumar coumarone-indene resins, a hydrocarbon resin used in floor tile, rubber products, paints; and terpene resins for adhesives. The Elastex line of plasticizers is another type of Barrett product used in the plastics industry. Genetron, made by the General Chemical Div. of Allied, is produced as a monomer for the production of fluorocarbon resins. The Semet-Solvay Div. is producing low molecular weight polyethylene used in paper bread wraps and, according to a recent bulletin, the parent company's expansion plans include a plant for the manufacture of polyethylene and another for nylon polymer, filament, and staple fiber.

The expansion of Allied Chemical & Dye Corp. has been outstanding during a period of outstanding expansion in the entire chemical industry. Since the end of World War II, Allied had spent $313 million for their new program through 1952. An additional $150 million was budgeted for 1953. Recently, an issue of $200 million of debentures was sold to finance projected expansion.

It can be expected that Allied will become a factor in any plastics material in which it is now basic from a raw material point of view. It now produces napthalene, chlorine, phthalic anyhdride, maleic anhydride, fumaric acids, urea crystal, alcohols, glycols, formaldehyde, phenol, and cresols. It is a bit difficult to think of many major plastics materials that cannot be started from that list of basic raw materials.

Fire at Glass Plant

FED by volatile chemicals, a flash fire recently destroyed the structure, manufacturing equipment, and raw material inventory at the Burbank, Calif., plant and offices of Glass Fibers, Inc. The damage is estimated at less than a quarter million dollars.

The plant housed general offices for the company's Western Div. and offices and manufacturing facilities

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for its Aero-Coustic Div., fabricators and suppliers of insulation components to the aircraft industry. The fire was caused by an electric spark which ignited volatile adhesive materials in a spray booth. Facilities will be rebuilt as quickly as possible.

The parent company's basic products (glass yarn, mat, and wool) have always been shipped direct to West Coast customers from the company's plants at Waterville and Defiance, Ohio, and the Burbank fire will have no effect on these shipments. Fabricated products made by the Aero-Coustic Div. were manufactured on readily replaceable equipment such as quilting machines, small conveyors, and other light machinery. Equipment to replace the damaged units has already been ordered and will be delivered promptly.

Resins for Glass

THE widespread use of plastics other than polyesters with fibrous glass is brought into focus rather sharply by checking the types of resins used as binders or as coatings for the glass material.

Information concerning these uses is contained in the annual report of Glass Fibers, Inc., which lists the various types of fibrous glass materials now on the market.

Upon checking various sources, we find that the following named resins are used with the different kinds of so-called glass wool:

Glass yarn or tape for electrical purposes is coated with silicone, polyethylene, vinyls of various types, and fluorocarbons.

Glass fibers in paper or felt used for filters, electrical insulating, and laminate reinforcements use silicone and melamine as well as polyester.

Spring-like glass wool material used for packaging delicate instruments, machinery, mountings, and so forth uses phenolic resin.

Fibrous glass pipe wraps are impregnated with epoxy, phenolic, or furfural resins.

Glass bats use styrene.

Biggest of all is phenolic resin, used as a binder in glass wool for thermal and acoustical insulation for buildings, piping, aircraft, railroad cars, refrigeration, and numerous other applications.

The amount of mineral wool sold for thermal insulation in the United States is not disclosed to the public. It has been estimated by reliable sources that over 690 million sq. ft. were sold in 1951; 20% more in 1952, and another comparable increase in 1953. No satisfactory figures on the weight of this material are available—there are many estimates, but they vary too much to be reliable. The amount of glass wool as compared to slag wool has been rapidly increasing—it is thought to be at least 35% of the total. Most mineral wool used for insulation contains anywhere from 2½ to 8% phenolic resin for a binder. Estimators consider that the total phenolic resin used for this purpose in 1953 will be between 26 and 30 million lb., which is about the same volume as the amount of polyester resins thought to be used with glass in 1953.

It's a growing business for phenolics. Several companies make resins almost exclusively for this purpose and there is even a suspicion that it is one of those things wherein the producer would be just as happy if his competitors didn't know how good the business has become. On the other hand, no one is making millions of dollars out of it—the margin of profit is very low.

PLASTICS PIPE ARTICLE AND CHART COMING!

A comprehensive source chart listing all makers of plastics pipe and fittings in the United States and the types and sizes of pipes made was to have been published in *Modern Plastics Magazine* this month, but has been postponed to the March issue because of the current simplification and standardization program of the plastic pipe manufacturers. Under the sponsorship of the Society of the Plastic Industry, this program is expected to bring early results, which should make the chart simpler and easy to use.

An article on the whole subject of plastics pipe from the standpoint of economics by our Senior Editor, R. L. Van Boskirk, will appear along with the chart in our March 1954 issue.

Pipe Dope

A NEW pipe-joint dope made of Du Pont's Teflon that promises benefits to processors of food, drugs, and chemicals because it is non-toxic and will not contaminate foodstuffs or pharmaceuticals has been announced by Plastics, Inc., Bristol, R.I. The pipe dope acts both as an electrical and thermal insulating material and is resistant to any chemical passing through pipes in production processes.

The material is said to speed up construction of pipe lines because it acts as a lubricant to make pipe-joining easier and faster. It is claimed to be effective on pipes of stainless or nickel steel, chrome-plated metal, and polyvinyl chloride. It works equally well on pipes of other plastics or hard rubber, and on aluminum and other metals that gall.

Applied as readily as any ordinary dope, it is adapted for both high and low temperature use over a range from −150 to 700° F.

The new dope prevents leakage even after joints have been backed off one full turn. A significant performance factor is that it permits easy disassembly of joints in materials that normally cannot be separated once they have been turned up tight.

Among other uses, the material is recommended for joining glass apparatus in either production or experimental laboratory projects.

Test samples in ¼-lb. cans, are available from Plastics, Inc.

Vinyl Wall Covering

PROTECTED color is the feature of a new embossed wall covering announced by United States Plywood Corp., 55 W. 44th St., New York 36, N. Y. The material, known as Kalitex, is an embossed vinyl sheet in a burlap weave pattern. The color, applied to the back of a transparent sheet, is completely protected from damage.

The clear vinyl sheet, 54 in. wide, is produced by Bakelite Co., a Div. of Union Carbide and Carbon Corp.,

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San Francisco . . . California
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30 E. 42nd St., New York 17, N. Y. The transparent sheet is embossed and color treated on the reverse side by the Kalistron Div. of United States Plywood Corp. and The Mengel Co., Louisville 1, Ky.

Mold Makers' Contract

FOR over a year a strong committee of mold makers, acting for the Plastic Mold Makers Division of the Society of the Plastics Industry, Inc., has been working on solutions for pertinent problems confronting mold makers and their customers. Major objectives are the establishment of an integrated apprenticeship training program, a set of mold making job descriptions and standard definitions, and a digest of voluntary provisions to serve as a guide in drawing up mold makers' contracts.

The Division's work on the study of voluntary provisions and clauses for mold makers' sales contracts has been completed with a view to more clearly defining the responsibility of the mold maker in relation to the molder and/or his customer. It is expected that procedures governing the purchase of molds will be simplified through the use of the suggested contract clauses.

Copies of the S.P.I. release on the subject "Comments on a Mold Maker's Contract" are available from the Society at 67 W. 44th Street, New York, N.Y.

Exposition and Conference

THE Sixth National Plastics Exposition of the Society of the Plastics Industry, Inc., scheduled for June 7-10 at the Public Auditorium, Cleveland, Ohio, will be held simultaneously with the 1954 Cleveland Plastics Conference. The exposition and conference represent an important "first" for Cleveland and a growing recognition of the industrial significance of the area to the $2-billion plastics industry.

E. L. Frantz, manager of the Fiberglas Div., Apex Electrical Mfg. Co., Cleveland, has been named chairman of the 1954 Cleveland Plastics Conference Committee. Other members of the Committee include George A. Fowles, B. F. Goodrich Chemical Co.; K. C. Norton, Heil Process Equipment Co.; C. A. Fromm, Jr., Plastic Engineering, Inc.; T. R. Neumann, American Agile Co.; Henry W. DeVore, Barrett Div., Allied Chemical & Dye Corp.; A. F. Kuthe, Ackerman Plastic Molding Div., Consolidated Iron-Steel Co.; George V. Goulder, International Molded Plastics Co.; and A. R. Morse, Injection Molders Supply Co.

Scholarships

ESTABLISHMENT of a senior-year technical scholarship program at 41 engineering colleges and universities has been announced by Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

The scholarships, individually sponsored by various divisions of Union Carbide, will cover the full tuition for a student's senior year and $200 for his necessary books and fees. The program, which includes one or more senior-year scholarships at each of the 41 participating universities, went into effect during the fall.

Isocyanate Prices

GENERAL price reductions for five different grades of isocyanates, ranging up to almost 50%, have been announced by Monsanto Chemical Co.'s Phosphate Div., St. Louis 4, Mo.

Tom K. Smith, Jr., general manager of the division, pointed out that the reduction has been made possible by improved manufacturing efficiencies, better supplies of raw materials, and increased consumption.

Vinyl Apparel

A MORE supple formulation of vinyl for lamination to fabric for outerwear has been developed by Monsanto Chemical Co.'s Plastics Div., Springfield, Mass. A company spokesman states that the new low-temperature formulation of Ultron vinyl achieves improved flexibility and better tear strength, especially at low temperatures. He predicts that the material would meet new style and functional requirements for men's and women's sports jackets, hunting coats, snow suits, and millinery. Because the material is easy to sew and tailor, it is expected to increase the popularity of the "leather look," already predominant in current fashions.

The Jason Corp., Hoboken, N. J., is now using the Ultron vinyl in fabricating a new material called Sofgrane, which is available in three weights for heavy and lighter weight sportswear. Sofgrane is distributed by H. P. Greenberg Co., Inc., 40 Worth St., New York, N. Y. The Jason organization believes that Sofgrane may lead to a new industry and has expanded its production facilities to meet volume needs immediately.

Colors for Sofgrane are styled by John and Earline Brice. The range of 15 colors includes high fashion shades, such as copper and peacock, as well as the traditional leather colors. Patterns, developed by Jason, simulate capeskin, calfskin, doeskin, and horsehide.

The material is produced in standard widths and therefore can be cut to better advantage by fabricators and cutters. More than a dozen layers may be cut in one operation.

Hexamine

COMMERCIAL production of hexamethylenetetramine, commonly known as hexamine, has been started at Mathieson Chemical Corp.'s Morgantown, W. Va., plant. The company is now offering the technical grade, granular material in carload quantities, packaged in moisture-resistant drums and bags. With the activation of its Morgantown unit, Mathieson becomes one of the country's major producers of hexamine.

The material's principal uses are as a convenient source of water-free formaldehyde in the manufacture of phenolic resins and as a hardening and insolubilizing agent for proteins. It also finds important use as a stabilizer in plastics and as a vulcanization accelerator in rubber.

35th Anniversary

ON January 15, 1954, Santay Corp., Chicago, Ill., celebrates its 35th anniversary.

One of the nation's oldest and largest plastics molding plants, Santay began as a tool and die shop in 1918 and moved into the fabrication of decorative cast phenolic materials

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"ELASTEX" 10-P Plasticizer (Diisooctyl Phthalate) (DIOP)
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in 1931. Daniel Szantay, one of the company's original partners and now its sole owner and president, installed the first injection machine in the Chicago area and one of the first in the nation, becoming one of the earliest molders of cellulose acetate.

Other pioneering activities to which Santay can lay claim included manufacturing of the first plastics knobs and tuning drums for Zenith Radio, the first butyrate radio cabinets for Admiral Corp., and the Ternstedt automobile door handle of plastic molded around a steel core. In World War II, Santay was entirely devoted to the production of proximity fuses of ethyl cellulose. And the company can take credit to have done much of the pioneering work on decorative coatings for plastics.

Today Santay Corp. reports that it does molding for virtually every large radio, television, refrigeration, building supply, air conditioning, and automobile accessory company in the country.

The plastics industries join with thousands of customers and friends of the corporation in offering congratulations on this 35th anniversary and best wishes for the future.

Acrylic Distributor

ESTABLISHMENT of a Stock Sheet Div. to supply acrylic sheets from stock to industrial and institutional users has been announced by Dura Plastics, Inc., 1 W. 34th St., New York 1, N. Y. The company will have available the standard thicknesses in both higher and lower heat-resistant types of material.

A price list for 23 thicknesses, ranging from 1/16 to 2 in. may be obtained from the company.

Vocational Use of Plastics

PLASTICS as a creative medium for avocational and vocational uses of the layman is the subject of a Ph.D. thesis by Dr. Robert Lloyd Cantor, 1450 Jesup Ave., New York 52, N. Y.

The full text of 276 pages, with 59 full pages of illustration, is available from University Microfilms, 313 N. First St., Ann Arbor, Mich. An abstract is available to anyone who will mail a stamped, self-addressed envelope to Dr. Cantor at the above address.

Public Relations Committee

NEW appointments to its Public Relations Advisory Committee have been announced by the Manufacturing Chemists' Assn., Woodward Bldg., Washington, D. C. Harry S. Ferguson, vice president of Allied Chemical & Dye Corp., has been appointed chairman to succeed Harold Brayman, director of public relations of Du Pont.

The following were named to serve as new members: D. C. Carmichael, Diamond Alkali Co.; Montgomery R. Budd, Hercules Powder Co., Inc.; Robert L. Taylor, Mathieson Chemical Corp.; Theodore Marvin, Michigan Chemical Corp., and C. Stuart Hoagland, replacing Henry Young of Interchemical Corp.

The following companies have been elected as new members of M. C. A.: Fisher Scientific Co., Lubrizol Corp., Michigan Chemical Corp., and Ringwood Chemical Corp.

Consulting Chemists

AT the annual meeting of the Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N. Y., the following officers were re-elected for another one-year term:

President: Foster Dee Snell, president, Foster D. Snell, Inc., New York, N. Y.

Vice president: Abraham Taub, consulting chemist, College of Pharmacy, New York, N. Y.

Secretary: Thomas P. Kearney, director, Industrial Testing Labs., New York, N. Y.

Treasurer: Percy E. Landolt, Landolt & Whitney, New York, N. Y.

Film Wrap in the Home

PLANS for national distribution of its household food packaging material, Saran-Wrap, which will be promoted on three television shows, has been started by The Dow Chemical Co., Midland, Mich. Saran-Wrap, the company's first consumer product to be marketed on a large scale, will also be promoted through newspapers, consumer, and grocery trade magazines.

The film is used for refrigerator and general storage purposes in the home. Commercial grades of the film has been used for several years for the packaging of processed meats, cheeses, baked goods, dried fruits, and other foods.

Polyethylene Prices

PRICES were again reduced on polyethylene in November when Bakelite Co. announced a 3¢ per lb. reduction. The new price means that most of the Bakelite polyethylene resins now sell for 41¢ per lb. compared to a previous 44¢ per lb. This was the third reduction in less than 14 months. When first produced 10 years ago, polyethylene sold for $1 a pound.

"Although polyethylene is still in short supply," states C. W. Blount, vice president in charge of sales, "the first of our three new plants is expected to come into full production in December. The second is scheduled to begin producing during the first half of 1954. These two new plants combined will produce about 120 million lb. annually or about 85% of the current total industry production."

Vinyl Cement

AVAILABILITY of a new vinyl-base cement which is completely resistant to hydrochloric acid, phosphoric acid, 60% sulfuric acid, 5% nitric acid, 5% chromic acid, sodium hypochlorite, benzene, gasoline, and chlorine dioxide at temperatures up to 150° F. has been announced by The Atlas Mineral Products Co., Mertztown, Pa., producers of noncorrosive material.

The product, called Vitroplast, does not require acid or alkaline setting agents. In addition to being used for joining brick in chemical process industries, Vitroplast has been used as a patching cement and for repair of ceramic units.

Metallized Film

THIN cast Teflon film is now being metallized in experimental quantities by Dilectrix Co., 211-48 Jamaica Ave., Queens Village 28, N. Y. Using the high vacuum technique, Teflon films in thicknesses of 0.00025, 0.0005, 0.001, and 0.002 in. have been

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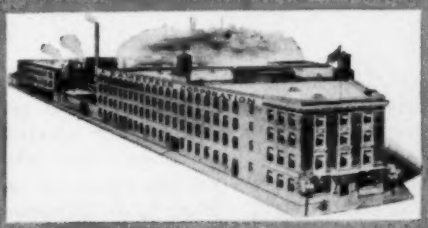

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coated with silver and copper. The material may be either fully or marginally coated. The company claims that probable applications for the film include its use in miniature capacitors, shielding, and printed circuits.

EXPANSION

Tri-State Plastic Molding Co., Inc., Henderson, Ky., announces the opening of a new plant in Owensboro, Ky. The new plant, occupying an area of 10,000 sq. ft., releases more space in the Henderson buildings for the company's die casting division, which has expanded its facilities to meet growing defense and civilian demands.

Celanese Corp. of America's Plastics Div. announces that construction is nearing completion on a new pilot plant center as an addition to present facilities of the Summit, N. J., research laboratories.

Plans include the building of a 50- by 100-ft. open concrete slab and a 50- by 50-ft. building. The slab will be used for the outdoor erection of "closed-system" continuous pilot units; the building will house those units which must be enclosed, as well as control panels for the outdoor pilot plants.

The pilot plant will provide equipment for the program of the Process Engineering Section. The company plans to build experimental units for process and production research involving current Celanese plastics, such as polyesters and new polymers.

Monsanto Chemical Co.'s Plastics Div., Springfield, Mass., is planning a $1,250,000 technical service and development program that will include a new research center for customers and industry in the plastics field. The company states that the new venture would intensify the search for new markets and new applications for plastics materials.

Construction of the research and development center, which will comprise a 3-story building providing 44,000 sq. ft. of additional floor space, will get under way shortly, and completion is anticipated late in 1954. It is expected to provide working facilities for about 125 chemists, engineers, and other technically trained personnel assigned exclusively to direct customer service for product and market development.

Monsanto's Organic Chemicals Div., St. Louis, Mo., announces that production changes have been completed to increase its tricresyl phosphate output more than 80 percent. The step-up was made to keep pace with the growing demand for tricresyl phosphate, both as the principal ingredient in TCP, Shell Oil Co.'s additive for gasoline, and as a plasticizer in the production of vinyl floor tile, wire coating compound, and film.

St. Maurice Chemicals, Ltd., jointly owned by **Heyden Chemical Corp.,** 342 Madison Ave., New York 17, N. Y., and **Shawinigan Chemicals, Ltd.,** Montreal, Quebec, has opened a new plant at Varennes, Quebec, to meet the needs of Eastern Canada's plastics, paint, textile, and pharmaceutical industries. The new plant has capacity for 30 million lb. of formaldehyde and 3 million lb. of pentaerythritol, the first to be produced in commercial tonnage quantities in Canada.

The Dow Chemical Co. has started production of Styron at its new plant in Torrance, Calif. The plant, located in the center of the West Coast plastics molding industry, is equipped with the latest processing equipment, a quality control laboratory, and a storage warehouse.

Dr. J. L. McCurday is plant manager and **D. W. Ryan,** production superintendent.

COMPANY NOTES

Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y., has made the following appointments in the Marco Products Dept. of the Plastics Div., Linden, N. J.: **Frank W. Turner** has been named sales service engineer for the purpose of developing applications of reinforced polyesters in the building of tanks, pipes, and other equipment in the chemical, oil, and transportation industries. **Edward W. Smith III** is now director of sales and **Richard J. Savage,** director of product application. Mr. Smith joined the company in 1944 and until recently was assistant director of sales of the Film Dept.; in 1951 and 1952, he served as chief of the Polymers Section, Plastics Branch of the Chemicals Div. of N.P.A. Mr. Savage, formerly associated with Owens-Corning Fiberglas Corp. and Parmelee Plastics Co., will direct the field technical service group, as well as supervise the application and resin control laboratories. **Richard N. Campen** and **Robert L. Johnson** have joined the field technical service staff. Mr. Campen will make his headquarters at 1422 Euclid Ave., Cleveland, Ohio, and Mr. Johnson at 1514 Merchandise Mart, Chicago, Ill.

Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., announces the appointment of **Dr. Raymond W. McNamee** as manager of research administration. He will help coordinate the research activities of all Union Carbide's laboratories where basic research and development is being done on alloys, chemicals, gases, carbons, and plastics. **Dr. Franklin Johnston** succeeds Dr. McNamee as superintendent of the Research and Development Dept. of **Carbide and Carbon Chemicals Co.,** a Div. of Union Carbide. As superintendent of the department, Dr. Johnston will be in charge of the company's research center at S. Charleston, W. Va.

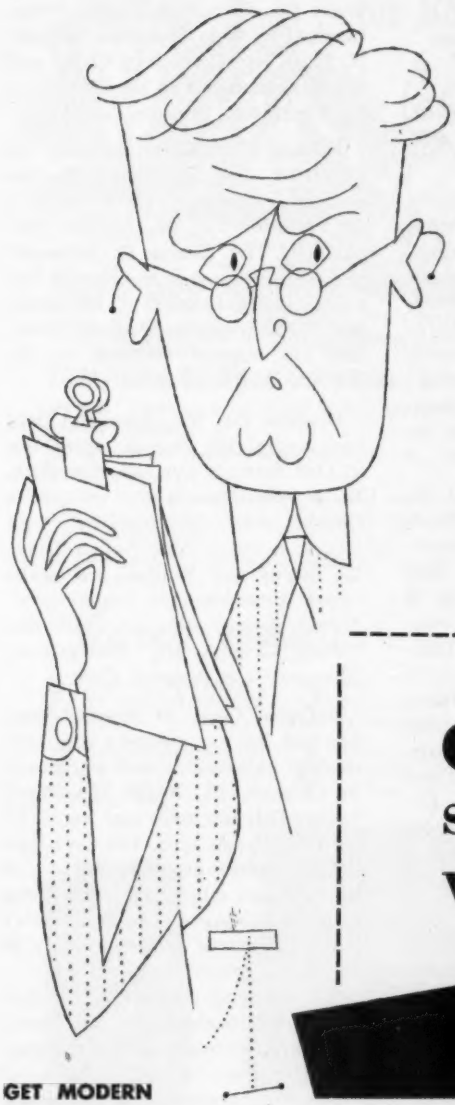
Union Carbide also announces that **Dr. James F. Eversole** has been named vice president in charge of research of the **Bakelite Div.**

Reichhold Chemicals, Inc. has moved its executive offices to 525 N. Broadway, White Plains, N. Y.

Textileather Corp., 607 Madison Ave, Toledo 3, Ohio, has appointed **Omer L. Dixon** industrial sales manager and **Lester F. Naylor,** product manager.

Celluplastic Corp., 50 Avenue L, Newark 5, N. J., has named **Anthony Nichols** as plant manager, replacing Ernest W. Halbach who has resigned.

Synvar Corp., Wilmington 99, Del., has appointed **W. R. Husen Co.,** 125 Woodland Ave., East Orange, N. J., as special representative to promote the sale of Synvar's industrial-type



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resins in diversified fields. The Husen organization was recently formed to specialize in the development and sales of synthetic resins.

Minnesota Mining & Mfg. Co., St. Paul 6, Minn., announces that **John V. Monley** has been named sales manager and will cover the San Francisco and Seattle areas; **Paul W. Myers** will be sales supervisor operating from Philadelphia; and **Jess G. Utter,** will be sales manager covering the Los Angeles territory.

Auburn Button Works, Inc., Auburn, N. Y., has moved its New York sales office to larger quarters at 17 E. 42nd St.

Heyden Chemical Corp., 342 Madison Ave., New York 17, N. Y., announces that **Kenneth Irey** has been appointed chemical production manager and **Ely Balgley,** supervisor of new product developments of the Market Development Dept. Mr. Irey's former affiliations were with Monsanto Chemical Co., Resinox Corp., and Commercial Solvents Corp.

The Foster Grant Co., Inc., Leominster, Mass., has appointed **John W. LaBelle** director of sales and **Richard B. Bishop** director of research of the Petrochemicals Div.

Julius Blum & Co., producers of plastics and metal working machinery have moved their general offices and warehouses to Carlstadt, N. J.

Industrial Radiant Heat Corp., Gladstone, N. J., has appointed **A. F. Perry Co., Inc.,** 185 Whitney St., Leominster, Mass., and **James L. Johnson,** 1230 N. Selva Dr., Dallas, Texas, as representatives for the company. They will handle the company's Plastiformer for vacuum forming of thermoplastic sheet and its fibrous glass and Superadiant heaters for industrial heat processing.

The Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., has opened a sales office at 640 Gilman St., Berkeley, Calif., headed by **Marvin C. Rasmussen.** Warehouse stocks of Baker products will be maintained by **Hawxhurst & Co.,** Second & Gilman Sts., Berkeley, and **W. R. Grace & Co.,** Second & Berry Sts., San Francisco.

Argus Chemical Lab., 633 Court St., Brooklyn 31, N. Y., producers of stabilizers for vinyl compounds, has installed a new 3500-gal. glass-lined reactor designed for severe chemical service at high temperatures. Manufacturer of the reactor, Pfaudler Co., Rochester, N. Y., claims that it is the largest glass-lined installation of its kind in the world.

Gering Products, Inc., N. 7th St. & Monroe Ave., Kenilworth, N. J., announces the following appointments: **Ralph F. Hayes** has been named vice president in charge of promotion; **Neil A. Koop,** vice president in charge of engineering; **Daniel Newman,** treasurer; **Gordon P. Schmelter,** technical director; **Wayne M. Schrag,** manager of technical service; **Raymond S. Mistretta,** manager of the Compounding Div.; and **David Levine,** manager of the Extruded Products Div. **Larry Gering** continues as president and **Herman Gering** as executive vice president and secretary.

General Electric Co.'s Silicone Products Dept. has established new sales districts in the East and Midwest. **Albert L. Baldock** has been appointed manager of the Eastern sales district, with offices at 570 Lexington Ave., New York, N. Y., and **Constantine L. Chase,** manager of the Midwestern sales district, with offices at 1105 Chester Ave., Cleveland, Ohio.

Packaging Institute, 342 Madison Ave., New York, N. Y., announces that **F. S. Leinbach,** secretary, assistant general sales manager, and member of the board of Riegel Paper Corp., has been elected president of the Institute. Mr. Leinbach succeeds Robert de S. Couch of General Foods. **R. Chester Reed** of the Texas Co. and **H. T. Holbrook** of the Flex-Vac Div., Standard Packaging Corp. have been elected vice presidents.

Plax Corp., West Hartford, Conn., has named the following distributors to handle its line of Plaxpak bottles: **Atlantic Glass Co.,** 294 Greenmount Ave., Baltimore, Md.; **Samuel Mallinger Co.,** Forbes & Gist St., Pittsburgh, Pa.; **Ohio Container Co.,** 366 N. Sixth St., Columbus, Ohio; and **White Container Co.,** 118 W. Second St., Cincinnati, Ohio.

Hooker Electrochemical Co., 14 Union St., Niagara Falls, N. Y., has made the following appointments in its research and development department: **Dr. Blaine O. Schoepfle** has been assigned to the plastics and resins group; **Leopold A. Robillard,** to the pilot plant development group; and **Dr. Samuel Gelfand,** to the fluorine chemicals group.

Koppers Co., Inc., Chemical Div., has opened its seventh warehouse at 1448 Wabash Ave., Detroit, Mich. **W. V. DeGalan** is the company's Detroit sales representative, with offices in the United Artists Bldg., 154 Bagley Ave. Koppers has established warehouses in Easthampton, Mass.; Kearny, N. J.; Nashville, Tenn.; Chicago, Ill.; Youngstown, Ohio; and Los Angeles, Calif.

Polymer Corp. of Pennsylvania, Reading, Pa., has opened a new midwestern sales office and warehouse in Chicago, Ill. **Ralph Blanchard,** former Polymer sales representative in the Chicago area, has been appointed midwestern sales manager of the Chicago office and **Alex Ross,** assistant manager. The new warehouse will carry a complete line of Polymer's products.

The company also announces that **B. C. MacDonald & Co.,** St. Louis, Mo., has been appointed sales representative for the distribution of Polymer's products in Missouri, Kansas, and Nebraska.

U. S. Rubber Co., 1230 Avenue of the Americas, New York 20, N. Y., announces the election of **John E. Caskey** as vice president of the company and general manager of **Naugatuck Chemical Div.** Mr. Caskey succeeds **John P. Coe,** vice president, who will handle U. S. Rubber's interests in the transfer of synthetic rubber plants from the Government to private industry. **George R. Vila,** former general sales manager of Naugatuck, has been named assistant general manager of the division.

U. S. Rubber also announces that **Joseph Ohzourk** has been appointed factory manager of its Chicago Die Mold Div., 4001 W. Wrightwood Ave.,

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Model 6003

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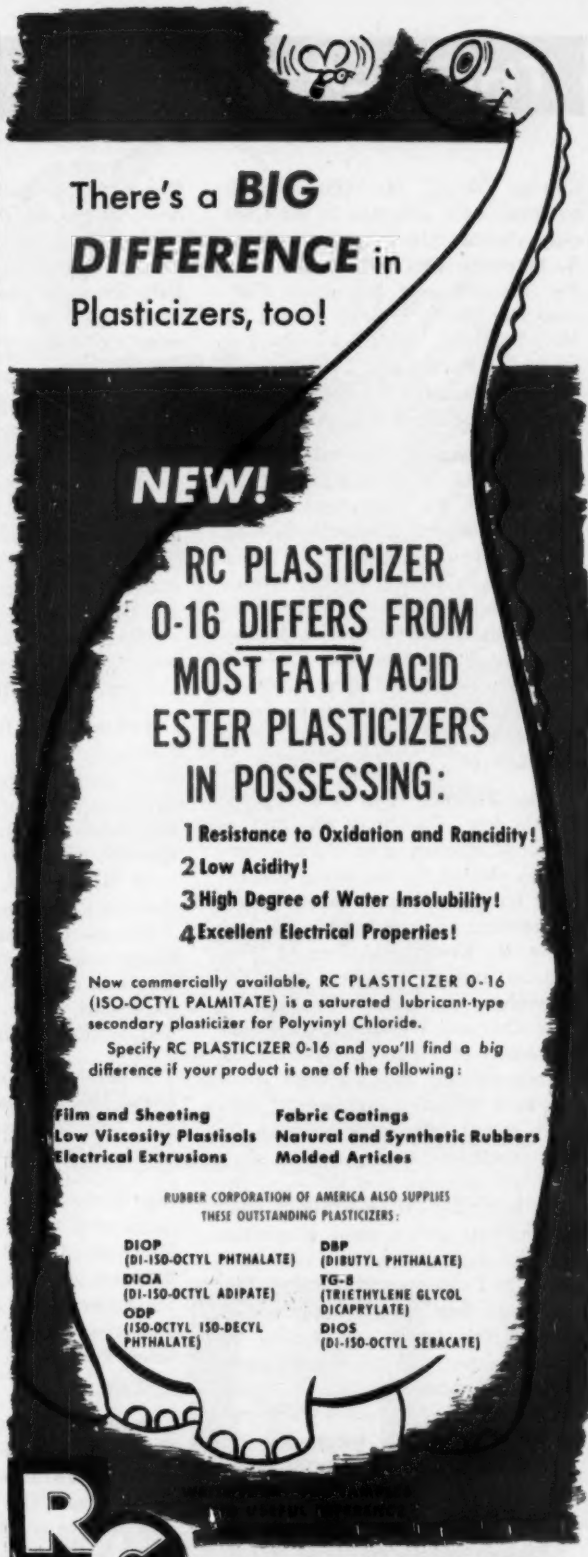

There's a BIG DIFFERENCE in Plasticizers, too!
NEW!
RC PLASTICIZER 0-16 DIFFERS FROM MOST FATTY ACID ESTER PLASTICIZERS IN POSSESSING:
1 Resistance to Oxidation and Rancidity!
2 Low Acidity!
3 High Degree of Water Insolubility!
4 Excellent Electrical Properties!
Now commercially available, RC PLASTICIZER 0-16 (ISO-OCTYL PALMITATE) is a saturated lubricant-type secondary plasticizer for Polyvinyl Chloride.
Specify RC PLASTICIZER 0-16 and you'll find a big difference if your product is one of the following:
Film and Sheeting
Low Viscosity Plastisols
Electrical Extrusions
Fabric Coatings
Natural and Synthetic Rubbers
Molded Articles
RUBBER CORPORATION OF AMERICA ALSO SUPPLIES THESE OUTSTANDING PLASTICIZERS:
DIOP (DI-ISO-OCTYL PHTHALATE)
DIOA (DI-ISO-OCTYL ADIPATE)
ODP (ISO-OCTYL ISO-DECYL PHTHALATE)
DBP (DIBUTYL PHTHALATE)
TG-8 (TRIETHYLENE GLYCOL DICAPRYLATE)
DIOS (DI-ISO-OCTYL SEBACATE)
RC
RUBBER CORPORATION OF AMERICA

274 Ten Eyck St., Brooklyn 6, N. Y. • 111 W. Monroe St., Chicago 3, Ill.

SALES REPRESENTATIVES: Ernest Jacoby & Co., 79 Milk St., Boston 9, Mass. Charles Larkin II, 250 Delaware Avenue, Buffalo 2, N.Y.

THE PLASTISCOPE

Chicago 39, Ill. Mr. Ohzourk, an administrative assistant in the Chicago plastics plant, replaces **Esper A. Peterson**, who will remain with the company as a consultant. Chicago Die Mold, formerly owned by Mr. Peterson, is the production center of Enrup and Uscolite, two of the company's recent developments in the thermoplastic field.

Grace Chemical Co., 60 Beaver St., New York 4, N. Y., announces the election of the following officers: **Elwyn E. Winne**, formerly assistant vice president of both W. R. Grace & Co. and Grace Chemical, is now vice president and a director of Grace Chemical. **William R. Thurston**, president of Thurston Chemical and Naco Fertilizer Co., and **John T. Whitely**, an assistant vice president of W. R. Grace Co., have been elected directors of Grace Chemical Co.

The Formica Co., 4621 Spring Grove Ave., Cincinnati 32, Ohio, at a special meeting of its board of directors elected the following Cincinnati business leaders to its board, expanding its membership to ten: **John W. Craig**, president of Aluminum Industries, Inc.; **John W. Humphrey**, president of Philip Carey Mfg. Co.; and **William S. Rose**, vice president of Fifth-Third Trust Co.

Reporting on the company's activity, **D. J. O'Conor**, president of Formica stated: "Formica's net sales for the first nine months of 1953 show a 16½% increase over the same period last year. All indications point to earnings in the same proportion to sales. Last year at this time, Formica had sales of $17,240,000. This year our first three-quarters show $20,100,000. As we move into the final quarter, we confidently expect sales to continue at this increased rate. Our sales and advertising program is geared to accomplish the desired result, to produce the greatest sales record in Formica's forty-year history."

Bassons Industries Corp., 1432 W. Farms Rd., New York 60, N. Y., announces that **Leon Brettler**, formerly affiliated with Du Pont, is now in charge of industrial engineering as assistant to **Murray Martin**, executive vice president and chief engineer; **Julius M. Medwin** has been promoted to project engineer in charge of thermoplastics; and **Virginia Sommers** has been engaged to design a gift and toy line to supplement the company's industrial products.

Libbey-Owens-Ford Glass Co.'s Corrulux Div. has established new general sales offices at 714 Prudential Insurance Bldg., Holcomb Blvd., Houston, Texas. **George D. Jefferson**, general sales manager, and his staff, and **Peter W. Fisher, Jr.**, regional manager of the southwestern area, will be at the new headquarters. The technical, accounting, and production offices will remain at the factory, 410 Holmes Rd., Houston.

Boston Woven Hose & Rubber Co., Cambridge, Mass., has organized a new plastics division for the development and manufacture of vinyl extrusions and elastomeric products. **Kenneth S. Goodyear**, formerly with U. S. Rubber Co. for 18 years, will manage the division.

The company also announces that a new sales division and warehouse has been established at 114 Express St., Dallas, Texas. **William H. Merriman** heads the division.

General American Transportation Corp., 135 S. LaSalle St., Chicago 90, Ill., has purchased **Parker-Kalon Corp.**, 200 Varick St., New York, N. Y., manufacturer of screw fastening devices. The organization will henceforth be operated as the Parker-Kalon Div. of General American Transportation Corp. The present management of Parker-Kalon will continue in control of operations and sales. Personnel consists of 800 employees.

Sullivan Springfield Paint Co., Springfield, Ill., is a new affiliate of **Sullivan Varnish Co.**, 410 N. Hart St., Chicago, Ill. The new company will carry a complete line of paints, enamels, lacquers, and vinyl coatings for the metal and plastics product manufacturers in central and downstate Illinois. It will also manufacture special industrial coatings in cooperation with the Sullivan laboratory in Chicago. **Joseph F. McMath** has been named manager and will direct the sales promotion activities and manufacturing operations.

PERSONAL

Cecil W. Humphreys has been appointed vice president in charge of manufacturing of **Shell Chemical Corp.**, 50 W. 50th St., New York 20, N. Y. Mr. Humphreys was formerly general manager and head of development of the company's manufacturing department.

Dr. G. A. Webb has been named assistant to the manager of the research department of **Koppers Co., Inc.**, Pittsburgh 19, Pa. Dr. Webb joined the company in 1941 under a Koppers Fellowship at Mellon Institute, where until 1943 he was in charge of certain catalytic developments.

Dr. R. M. Lacy is now technical director of **Michigan Chrome & Chemical Co.**, 6340 E. Jefferson Ave., Detroit 7, Mich. He will be in charge of research and development work on vinyl plastisols and other synthetic coatings for the electroplating, wire goods, textile, automotive, and electrical equipment industries. For the past ten years Dr. Lacy had been laboratory manager of General Electric Co.'s Major Appliance Div., Bridgeport, Conn.

Eileen M. Dowling has been appointed advertising manager of **Alsynite Co. of America**, 4654 De Soto St., San Diego 9, Calif.

E. P. Additon is now sales engineer of **Blaw-Knox Co.'s Chemical Plants Div.**, Pittsburgh, Pa. Mr. Additon will offer the processes and engineering-construction services of the company to chemical and industrial clients in a five-state area.

Herbert H. Shepardson has joined **Holman Mfg. Co., Inc.**, Hoosick Falls, N. Y., as sales manager. He was formerly connected with General Electric Co.

Richard M. Paget has been elected a director of **Atlas Powder Co.**, Wilmington 99, Del. Mr. Paget is senior partner in the New York and Chicago management consultant firm of Cresap, McCormick & Paget.

Eric Cizek has been named chief engineer of the plastics division of **The Englander Co., Inc.**, 227 N. War-

CAN BE USED AS AN EXTENDER

IS COMPATIBLE WITH OTHER PLASTICIZERS

One of the important properties of S/V *Sovaloid C*—Socony-Vacuum's versatile plasticizer for vinyl resins and nitrile rubbers—is that *it won't migrate* from your finished products. But it also has many other processing advantages! For example . . .

Saves Up to 90%

S/V Sovaloid C is completely compatible with all vinyl and nitrile rubber compounds, and is well suited to plastisol formulations. It gives good flexibility, excellent oil resistance and high tensile strength. And it is still the most economical plasticizer available for vinyl resins—*can save you from 30 to 90 per cent* of plasticizer cost when used to extend more expensive ester-type plasticizers! Ask your Socony-Vacuum man about S/V Sovaloid C!

Process Products
SOCONY VACUUM

SOCONY-VACUUM
Process Products

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

THE PLASTISCOPE

wick Ave., Baltimore 23, Md., replacing Robert E. Waugh who has resigned. Mr. Cizek was formerly associated with Delaware Research & Development Corp. and John Hopkins Institute of Cooperative Research.

Robert Carr has been appointed sales engineer of **Reed-Prentice Corp.**'s branch sales office at 4001 N. Elston Ave., Chicago 4, Ill. He has been with the organization since 1942.

Clint Booth has been named general sales manager of **Flek Corp.**, 2252 E. 37th St., Los Angeles 58, Calif.

H. Erich Illich has joined **Herb-Shelley, Inc.**, Farmington, Minn., producers of polyethylene bags and liners, as vice president in charge of manufacturing. Mr. Illich was formerly assistant sales manager in charge of the plastics bag department of Bemis Bro. Bag Co.

A. A. Anderson is now a sales representative for **Connecticut Plastic Products Co.**, Waterbury 89, Conn., with headquarters at 17 E. 42nd St., New York 17, N. Y.

Dr. R. N. Lulek has been elected a director and vice president of manufacturing and research of **Grace Chemical Co.**, 60 Beaver St., New York 4, N. Y. Dr. Lulek was formerly a director and vice president of Heyden Chemical Corp. and St. Maurice Chemical Ltd., Montreal.

Walter T. Meinert has been appointed assistant director of the Development and Service Dept. of **Emery Industries, Inc.**, 4300 Carew Tower, Cincinnati 2, Ohio.

S. Sydney Minault has been named chief engineer of **National Research Corp.**, 70 Memorial Dr., Cambridge, Mass.

Robert H. Hose has been elected president of **The Society of Industrial Designers**, 48 E. 49th St., New York 17, N. Y.

Dr. Howard L. Gerhart, director of research of **Pittsburgh Plate Glass Co.'s Paint Div.**, 632 Ft. Duquesne Blvd., Pittsburgh 22, Pa., has been awarded an honorary Doctor of Science degree by Franklin and Marshall College. He received the award in recognition for his outstanding leadership and administrative ability in the field of industrial research. Dr. Gerhart was instrumental in the development of Selectron resins now widely used in the plastics industry. He makes his headquarters in Milwaukee, Wis.

Harald S. Julsrud, fats and oils chemist and sales executive has joined **Alkydol Laboratories, Inc.**, 3242 S. Fiftieth Ave., Cicero 50, Ill., as sales manager. Under the guidance of Mr. Julsrud, Alkydol will expand its sales into the polyester and emulsion fields. A complete line of these products has been developed during the last four or five years.

Sumner Tinkham has joined **Boonton Molding Co.**, Boonton, N. J., as assistant director of engineering. He will assist **R. W. Post**, director of engineering, in handling customer relations on production problems. Mr. Tinkham was formerly associated with Shaw Insulator Co. and General Electric Co.

John E. Powers has been promoted to vice president of **The General Tire & Rubber Co.**, 1708 Englewood Ave., Akron 9, Ohio. Mr. Powers has been serving as general sales manager of plastics and special products.

Milton Rabinowitz is now vice president and general manager of **First Machinery Corp.**, 157 Hudson St., New York 13, N. Y.

John R. Cummings has joined the sales staff of **Varcum Chemical Corp.**, Niagara Falls, N. Y. He was formerly connected with The Borden Co.'s Chemical Div.

W. W. Knight, Jr. has been appointed vice president of **Allied Chemical & Dye Corp.'s Barrett Div.**, 40 Rector St., New York 6, N. Y. He will be in charge of the division's industrial resin program. Mr. Knight's former connections were with Libbey-Owens-Glass Co. for 7 years and with Michigan Alkali Co. for 11 years. With the exception of his service during World War II as Lt. Col. in the Ordnance Dept. of the U. S. Army, he has devoted all of his time to the chemical industry.

George L. Smead, associated with **Libbey-Owens-Ford Glass Co.** for 20 years, has been transferred from its former Plaskon Div. to become manager of sales to the reinforced plastics industry. He will work closely with **Don W. Lyon**, manager of textile sales of fibrous glass, and also with manufacturers of polyester and other resins used in producing fibrous glass reinforced materials. Mr. Smead's headquarters will be at the Fiber Glass Div., Wayne Bldg., Toledo, Ohio.

Deceased

Dr. Gordon F. Dittmar, market analyst, and **Charles Waggaman Berl**, market survey manager of the Sales Research Div. of **Hercules Powder Co., Inc.**, Wilmington 99, Del.

MEETINGS

Nov. 30-Dec. 5—Chemical Industries, Exposition, Commercial Museum and Convention Hall, Philadelphia, Pa.

Dec. 13-16—American Institute of Chemical Engineers, Annual Meeting, Hotel Jefferson, St. Louis, Mo.

Jan. 25-28, 1954—Plant Maintenance and Engineering Conference and Show, International Amphitheatre, Chicago, Ill.

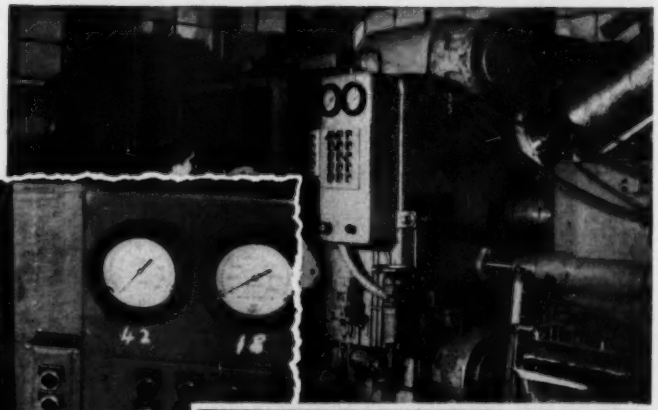
Jan. 26-28—Tenth S.P.E. Annual Technical Conference, Royal York Hotel, Toronto, Canada.

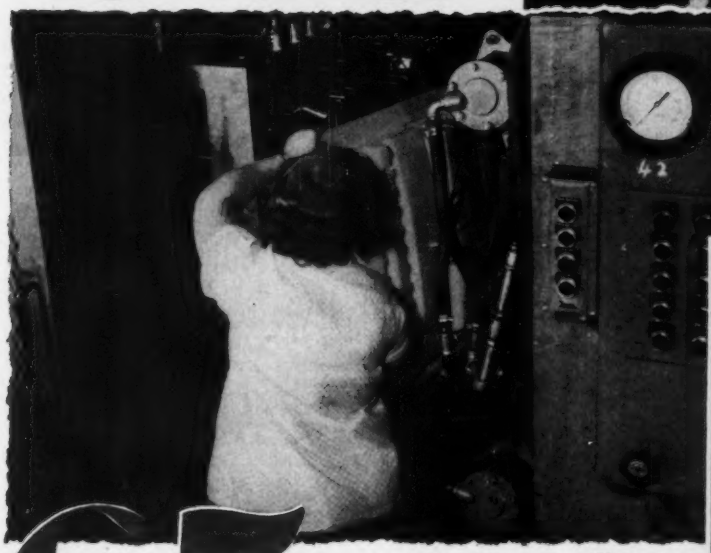
Jan. 31-Feb. 3—Western Merchandise Exhibitors Assn., Western China, Glass, Gift, Jewelry, Toy, Stationery, and Housewares Show, Civic Auditorium, Plance, St. Francis, and Sir Francis Drake Hotels, San Francisco, Calif.

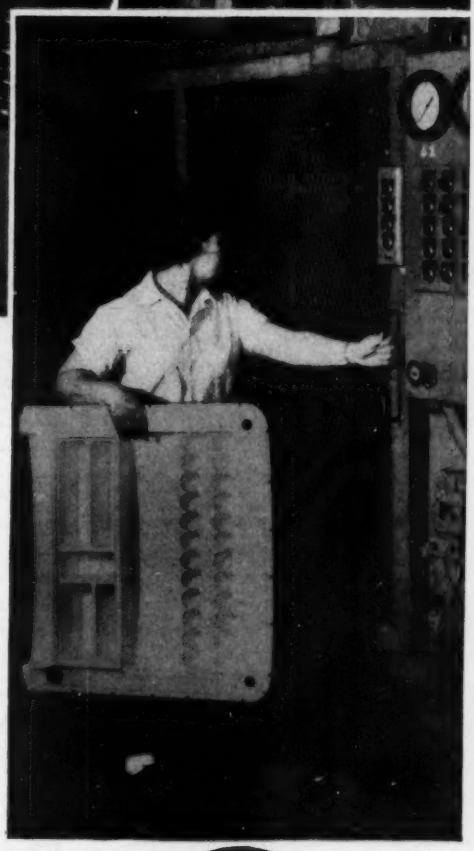
Feb. 14-17—Western Merchandise Exhibitors Assn., Pacific Northwest China, Glass, Gift, Stationery, Jewelry, Toy, and Housewares Show, Civic Auditorium Seattle, Wash.

The Fifth Film, Sheeting, and Coated Fabrics Division Conference of the S.P.I. announced here last month for December 3-4, has been postponed to an as yet indefinite date in the Spring of 1954.

92 OUNCE PIECE MOLDED EVERY







65 seconds

With The W-S 300 Oz. Plastics Molding Machine

Photos, furnished by General Machine & Tool Works, show production-action shots in their modern Walled Lake, Michigan plant. Here you see an International Harvester inner door liner, molded of Styron, coming off the production line. This single unit piece weighing 5 lbs., 12 ounces requires 784 square inches of projected area. Its average thickness is .115 inches. It measures 27½ x 28½ inches and it's a flash-free molding.

Speed . . . economy and maximum production efficiency is what you get with every Watson-Stillman Plastics Molding Machine. Capacities from 1 to 300 ozs. They're the first choice of the industry. Write for literature covering Injection, Transfer and Compression Molding Machines.

W-S HYDRAULIC
ESTABLISHED 1848

THE WATSON-STILLMAN COMPANY
DIVISION OF H. K. PORTER COMPANY, INC.
150 Aldene Rd., Roselle, New Jersey

Foreign Sales Representatives: OMNI PRODUCTS CORP., 460 Fourth Avenue, New York 16, N. Y.
Correspondents Throughout the World

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CLASSIFIED ADVERTISEMENTS

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EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

MACHINERY and EQUIPMENT FOR SALE

HYDRAULIC PRESSES: 1—Birdsboro, 1800 tons, down-acting ram 36" dia. x 24" stroke, 48" DLO, 42"x42" bed area. 1—Clearing, 500 tons, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding. 1—Farrell, 390 tons, 48"x48" steam platens, 2 openings, 4 rams 10" dia. x 24" stroke, approx. 15" per opening. 1—Watson-Stillman, 100 tons, 11¾"x12" platens, 22½" DLO, ram, 8" dia. x 15" stroke. 1—Watson-Stillman, 100 tons, down-acting, 22"x20" bed area, 24" DLO, ram, 11½" x 9½"x6" stroke, self-contained; complete with 15 HP MD Vickers Pump. Unit is practically new. 1—HPM, 100 tons, 18"x18" Platen Area, ram 8" dia. x 18" stroke, 30" DLO, Steel Cylinder, 4000 PSI. 2—Burroughs, 75 tons, down-acting, 17½" x17" electric-heated platens, 13½" DLO, ram, 8" dia. x 10" stroke, complete with 7½ HP MD Oilgear Pump. 1—Watson-Stillman, 50 tons, down-acting, platen area 25"x 25½", 25" DLO, ram, 8" dia. x 14" complete with 7½ HP MD Pump. 1—New Laboratory Press, 12 tons, hand operated, fitted with 8"x8" electrically heated platens. 3—Denison, 4 tons, Model FH4-CO1, down-acting ram, 3½"x12" stroke, 18" DLO, bed 22"x14", 8½" throat, complete with 3 HP MD Pump, time delay control, all valves, piping, gauges, controls. 1 machine slightly used, 2 units still in original crates. 1—Standard Machinery Co. #14 Toggle Press, 150 tons, platen area 34"x28", 6" DLO, 3½" stroke, arranged for motor drive, practically new. ALSO: Plastics & Rubber Extruders, Mills, Mixers, Grinders, Injection Molding Machines, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683 Frelinghuysen Avenue, Newark 5, New Jersey. Tel. Edgelow 8-2500. What have you for sale? What are you looking for?

FOR SALE: Rubber and Plastic Equipment. Farrell 16" x 48", 15" x 36" and 6" x 12", 2 roll rubber mills. Other sizes up to 84". New Seco 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. Stokes #280, 4" diam. Preform Machine. W.S. 300 ton downstroke Hydr. Press, 30" x 30" Platens self contained. 350 ton 22" x 24". New Loomis 340 ton & 50 ton Hydr. Presses. 24" x 56" Platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 150 ton 30" x 60". 100 ton 24" x 24". Elmes 75 ton 30" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump. 250# W.P. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers 100, 50, and 9 gal. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N.Y. STerling 8-1944.

FOR SALE: 1—6"x12" Lab. Roller Mill; 2—Thropp 16"x40" and Farrell 15"x36" Mills; 1—Reed-Prentice 4 oz. Model 10A Injection Molding Machine; 1—No. 1 Banbury Mixer; 1—3 Roll Vaughan Calender 18"x44"; 7 Dry Mixing Blenders up to 5,000 lbs; 3—Micro Pulverizers; 2—Ball & Jewell Cutters; 6—18"x18" Hydraulic Presses; 1—Kux Model 50 Preform Machine; 1—Day Ro-Ball No. 71 S/S sifter. Also Grinders, Extruders, Pulverizers, Baker Perkins Mixers, Screens, Kettles, etc. Send us your inquiries. We buy your idle machinery. CONSOLIDATED PRODUCTS CO., INC., Observer Highway, Cor. Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N.Y. Tel: BArclay 7-0600.

SAVE WITH GUARANTEED REBUILT EQUIPMENT: 2 New R. D. Wood 500 ton EMBOSSING PRESSES: 54"x26" platen: HYDRAULIC PRESSES: 42"x37", 20" ram, 475 tons; 2-7 opening 27"x27", 18" ram, 565 tons; 24"x24" 12" ram, 170 tons; 24"x20" 10" ram, 118 tons; 20"x20" 10" ram, 118 tons: 20"x20" 10" ram, 200 tons; 30"x20" 8" ram, 75 tons; 24"x20" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 15"x15" 8" ram, 75 tons; 2-19"x24" 10" rams, 78 tons; 12"x12" 6½" ram, 50 tons; 14" x 14" 8" ram, 50 tons; 8"x 9½" 4½" ram, 20 tons; 16"x16" 3½" rams, 12 tons; PREFORM PRESS: Colton 5½T, Reeves Drive and Motor; LABORATORY PRESSES: Carver & Watson Stillman Units; NEW UNIVERSAL DUAL PUMPING UNITS: 3-15 HP; NEW LABORATORY MILLS, and CALENDERS; EXTRUDER: Modern Plastic 1½"; ACCUMULATOR: HPM 6" ram 2500#, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson Street, New York 13, N. Y.

FOR SALE: 15 ounce Crown Moldmaster Injection molding machine, new October 1952, in excellent working condition. Desirous of obtaining a machine which will mold Vinyls. Price $15,000 f.o.b. plant. Can be seen in operation AVSCO, INCORPORATED, 940 Isley Blvd., Excelsior Springs, Missouri.

COMPLETE MOLDING SYSTEM, still in operation, consisting of 5 press, water hydraulic, and central pump unit: (2) Baldwin—20"x20", 14" stroke, 12" ram, 100 tons; (1) T. Shriver—18"x18", 9" stroke, 12" ram, 100 tons; (1) Watson Stillman—16"x18½", 9" stroke, 18½" ram, 50 tons; (1) Baldwin 14½"x15½", 14" stroke, 8" ram, 50 tons; all platens electrically heated, complete with controls for automatic or manual operation. (1) Worthington Pump and Accumulator, 20 H.P. Motor, 2500 P.S.I. 100 g.p.m.; (1) Southwark Hylo power unit. System complete with piping, gauges, valves, spare parts, etc. May be seen in operation. Unusual opportunity for substantial savings on this unit. Location: Philadelphia. Reply Box 1216, Modern Plastics.

FOR SALE AT GREAT SAVINGS
Colton 2RP and 3RP Rotary and 4T Tablet Machines. Day 40x120 Single Deck Sifter. Great Western—all models. Mikro Bantam, 1SH, 2TH, 3W, 3TH, 4TH Pulverizers; Schutz O'Neill Mills. Baker Perkins Heavy Duty Steam Jacketed, double Arm from 12 to 150 gal. Mixers. (Unidor and Vacuum also) J. H. Day, from 4 up to 75 gal., Imperial and Cincinnatus, D. A. Jacketed, Sigma Blade Mixers. Day & Robison Dry Powder Mixers, 100 up to 10,000 lbs. Package Machy, FA, FA4, Miller Hayssen 3-7 Scandia auto, Wrappers. Hudson Sharp Campbell auto. Cellophane Wrapper.
REBUILT AND GUARANTEED—This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements.
UNION STANDARD EQUIPMENT CO.
318-322 Lafayette St., New York 12, N. Y.

FOR SALE: Thermal Dielectric Pre-Heater Super Chief Model. This machine has had only a few hours use in research now completed. Capacity—5 lbs. per minute; platen area, 670 sq. in.; adjusting height, 1" to 4". Power required: 230-460 volts, A.C., three phase, 60 cycle. Angle steel frame encased in heavy gauge sheet metal, finished in durable, baked-on, grey wrinkle paint. Mounted on casters for easy moving. Complete?y automatic, built-in safety features. Photograph of machine is available or unit may be inspected at our Ohio plant. Reply Box 1227, Modern Plastics.

TWO 28-oz. WATSON-STILLMAN Injection Molding Machines for sale. Built 1947 & 1948, complete with 28-oz. and 32-oz. cylinders. Can be inspected in production. Write Box 1207, Modern Plastics.

PARTIAL LIST of available machines, may be inspected in operation: Small plastic molding plant in New England w/4 H.P.M. machines, etc. for sale; new 4 ounce Acme, November delivery; 4 oz. H.P.M. and 9 oz. H.P.M., used very little, $11,000. for both; 2 oz. DeMattia hydr. $1,250.; 6 oz. Lester Model 1½L; 60 ounce Jackson & Church, used 1 week. 32 ounce Reed-Prentice, new 1950. 24 ounce DeMattia. 22 ounce Impco vertical. 22 ounce Reed-Prentice, new 1948. 16 ounce Reed-Prentice, new 1946. 12 ounce Lester. 12 ounce Reed-Prentice, new 1950, will accept terms. 9 ounce H.P.M., 1946. 12 ounce Watson-Stillman, new 1953. 4 ounce Reed-Prentice, new 1945. 4 ounce Lester. 3 ounce Fellows, new. 2 ounce Fellows, 1951. G.E. Dielectric Heater; vacuum plater 4' cap.; Stokes 15 ton single stroke preform press 300 ton French Oil self-contained hydr. compression press; 200 ton Stokes; 150 ton Stokes; 60 ton Watson; 50 ton Stokes automatic, Model 235-A; #½ Cumberland scrap grinder 5HP. ACME MACHINERY & MFG. CO,. P.O. Box 731, 102 Grove St., Worcester, Mass.

FOR SALE: Injection Presses: 32 oz., 24 oz., 12 oz., 4 oz. Reeds, 4 oz., 9 oz. HPM, 4 oz. (1952) Impco. 1 oz. VanDorn, 4 oz. Makray. Extruders: 1½" NRM. Scrapgrinders, Ovens, Laboratory Presses. 1—Stokes automatic 50 tons 235A. Preform presses Stokes 280C Kux 25. 42" Slitting machine. Complete Wirecoating & drying unit. 3HP Gasboilers. List your equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

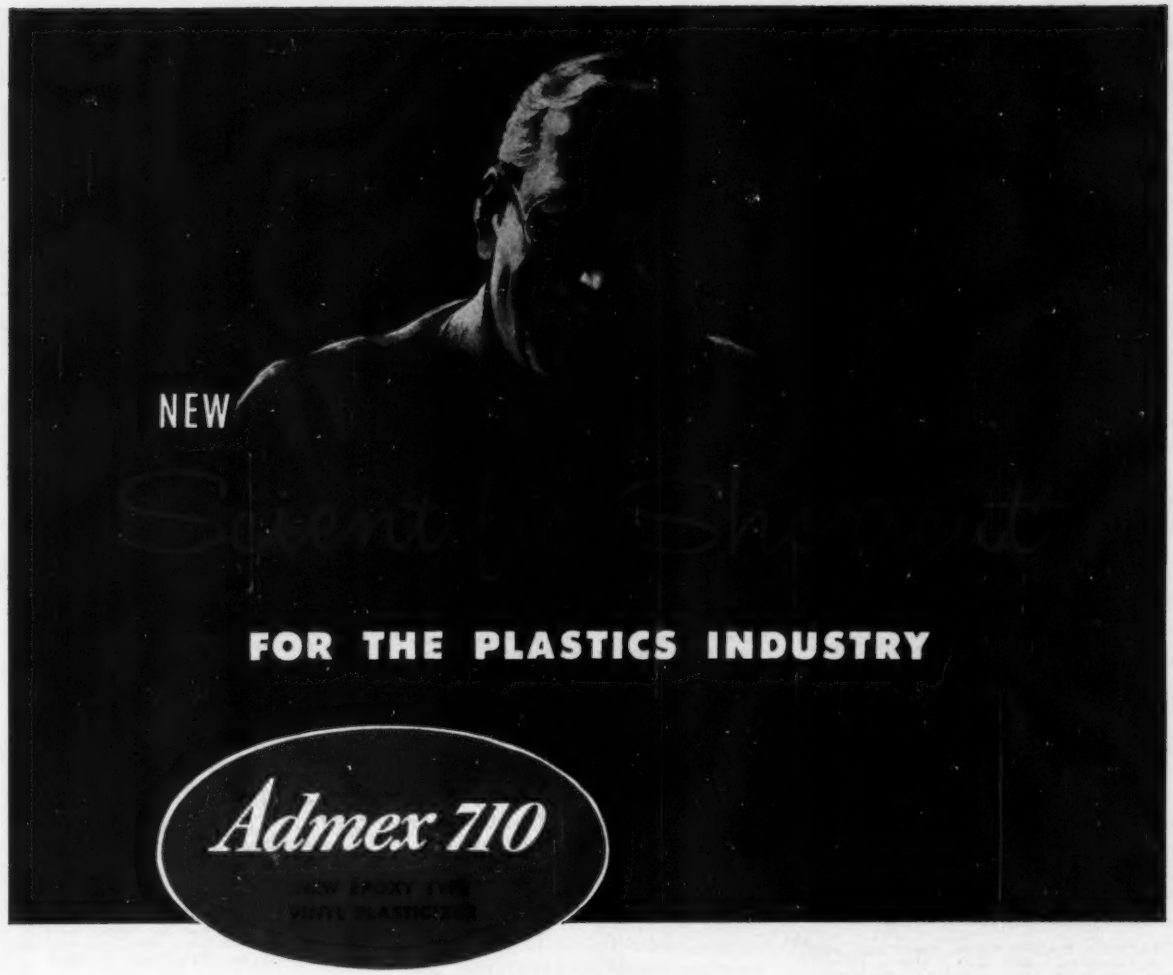
FOR SALE: POLYVINYL ACETATE UNIT, capacity 1000# per hour. Includes, 500 gal. s/s Reaction Kettle with Condensers and Xpl motor; 6' dia. x 15' long s/s, d.h. Rotary Resin Dryer; solid bowl type, all s/s Centrifuge, 30" x 40", m.d.; 3—s/s Tanks, 500 gal., 250 gal.; 3—s/s Pumps with Xpl motors. Equipment is NEW, entirely of 316 stainless. Priced at fraction of new cost. Drawings available. CONSOLIDATED PRODUCTS CO. INC., Observer Highway, Cor. Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N.Y. Tel: BArclay 7-0600.

FOR SALE—One 400 ton Birdsboro Hydraulic Press, 18" main ram, 3½" side ram pullbacks, 26" travel, 48" daylight, platen area 30" x 40", high and low pressure pump with oil storage tank and 40 HP motor. Price $10,000 F.O.B. Newhall, LOVEN CHEMICAL OF CALIFORNIA, 244 Pine St., Newhall, Calif.

SACRIFICE, 2 Oz.-$3100. SAV-WAY Injection Molding Machine—5 H.P. motor. Original Owner. Used Only 3 Weeks. Can Demonstrate perfect running condition. Excellent for medium and small size orders and for experimental runs. Must sell immediately, for $1400. or highest bidder—Call WH 9-2106, White Plains, N. Y.

STOKES ROTARY PELLET PRESSES (5): 16-punch RD-3 and 15-punch RDS-3. (2) Kux model 25 Presses 21 and 25 punch. Ball & Jewell #1½ stainless steel rotary cutter. Mikro Pulverizers #1-SH, #1-SI, #2-TH, #2-SI & 24". Large stock steel and stainless tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Philadelphia 22, Pa.

(Continued on page 242)



Here's an entirely new idea for the plastics industry . . .

a *Scientific Shortcut* which will reduce your production costs, trim your plasticizer inventory, and lower your shipping costs.

This money-saving idea is based on *Admex 710*, ADM's new multi-purpose, epoxy type vinyl plasticizer which will replace several specialized plasticizers, yet improve the quality of your products. *Admex 710* offers a unique combination of the ten basic qualities sought by vinyl processors.

No other plasticizer on the market imparts such a high degree of performance in these ten essential qualities.

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SCIENTIFIC SHORTCUT

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ARCHER-DANIELS-MIDLAND CO.
600 Roanoke Building, Minneapolis 2, Minnesota

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☐ Please send me *Admex 710* Evaluation Sample

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Firm _____

Street _____

City _____ *Zone* ____ *State* _____

MP

CLASSIFIED ADVERTISING

(*Continued from page 240*)

FOR SALE: 4—Rebuilt 4-color print machines, 60" face x 60" diameter impression cylinder. Perfect condition. Excellent for printing Vinyl, Acetate, Oil Cloth or Textiles. Can also be converted to 6-colors. LEMBO MACHINE WORKS, INC., 248 East 17th Street, Paterson, N. J.

Thermall Conveyorized ELECTRONIC HEATER. 5 KW output at 60 megacycles. Grounded copper conveyor 8" wide x 6 ft. long. Variable Speed. Adjustable top electrode. Adjustable hopper feed. Equipped with vapor exhaust system. Used only 200 hours in experimental department. Reply Box 1217, Modern Plastics.

FOR SALE: (1) 24 oz De Mattia Injection molding machine. 600 ton clamp. Machine can be seen operating on production basis now in Long Island, New York. Price $19,000. Box MP 1578, 221 W. 41st St., N.Y.

FOR SALE: 20' National Rubber Conveyor, 6" wide heat resistant rubber belt, ¾ H.P. Graham variable speed drive. For information write or call ALMA PLASTICS COMPANY, Alma, Michigan.

HYDRAULIC PRESSES rebuilt, repaired. Used presses from laboratory to 1000 tons standard and special, molding and hobbing presses etc. Used pumping units up to 10,000 p.s.i. all capacities. CLIFTON HYDRAULIC PRESS CO., 291 Alwood Rd. P.O. Box 325, Clifton, New Jersey.

FOR SALE: 2—3000# jacketed ribbon blenders, MD. 1—10" x 20" 2 roll plastics mill, MD. 4 Compression molding presses 50 to 300 ton. Also injection, etc. CHEMICAL & PROCESS MACHINERY CORP., 146-148 Grand Street, NYC 13, WO 4-8130.

MACHINERY and EQUIPMENT WANTED

WANTED: Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P. O. Box 1351, Church Street, New York 8, N.Y.

WANTED: 16-02 H.P.M. injection molding machines with or without preplasticizers, Late models. Must be in good condition. FRAWLEY MANUFACTURING CORPORATION, Salinas, Puerto Rico.

WANTED: Stokes Standard 150-300 ton Presses, large ram presses from 16" up. Large Preform Presses 1½" up. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson St., New York 13, N. Y.

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., Observer Highway, Cor. Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N. Y. Tel: BArclay 7-0600.

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FOR SALE:
10,000 lbs. VIRGIN GRAY STYRON 27c per lb. Also large inventory of spot lots and reground molding powders at attractive prices.
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152 Centre Street B'klyn 31, N. Y.
Tel: Main 5-5553
Not connected with any other firm of similar name.

POLYETHYLENE OFFERED — NATURAL VIRGIN CRYSTALS. Manufacturers original packing and put up. DYNH 3 (Bakelite) or ALATHON 10 (Du Pont) Prompt shipment from holding Warehouse inventory. Prices commensurate with market at all times. THE CLEMENTS COMPANY, 125 S. Front Street, Phila. 6, Pa. Tel: MArket 7-7122.

POLYSTYRENE TUBING: 135 Lengths 52" long, 3" O.D. x 2¾ I.D. 129 lengths 52" long, 4⅛" O.D. x 3 13/16" I.D. Good buy—Make offer. SUDBURY LABORATORY, South Sudbury, Mass.

POLYETHYLENE REPROCESSED PELLETS AND SCRAP. Also Spot Lots Virgin Resin. AMERICAN VINYL CORP., 38-01 23rd Ave., Long Island City 5, New York. AStoria 4-1768.

FOR SALE: 3,500 lbs. Baby Pink Cellulose Acetate Sheeting, .020, Original Containers 35c per pound. CLAUDE P. BAMBERGER, INC. 152 Centre Street, B'klyn 31, N.Y. Tel: Main 5-5553. Not connected with any other firm of similar name.

MATERIALS WANTED

WANTED: PLASTIC SCRAP IN ANY FORM. Rejects—Nozzle Waste—Surplus Inventories, Obsolete Virgin Molding Powders—Acetate, Butyrate, Ethyl Cellulose, Hi Impact, Nylon, Polyethylene. Polystyrene, Vinyl, Acrylic. Highest Prices Paid. We also reclaim your scrap. Consult us for Reprocessing Charges. GERING PRODUCTS, INC., 7th St., Kenilworth, N.J. Cranford 6-2900.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 2004 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WANTED: VIRGIN POLYETHYLENE. Alethon 1 & 10; DE 2400; DYNH 3. Need continuous supplies. AMERICAN VINYL CORP., 38-01 23rd Ave., Long Island City 5, New York. AStoria 4-1768.

FABRICATORS—MOLDERS
VACUUM FORMERS
Inquire about our unique plan to obtain best possible value from your SCRAP—REJECTS—SURPLUS INVENTORY.
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152 Centre Street B'klyn 31, N. Y.
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WE ARE ALWAYS IN THE MARKET FOR THERMOPLASTIC SCRAP AND REJECTS OF ALL KINDS. Also surplus or obsolete lots of reprocessed and virgin materials purchased. Highest prices paid. Custom grinding and compounding to your specifications. PLASTIC MATERIALS, INC., 589 Main Street, Westbury, L.I., N.Y. DIAL—WEstbury 7-7124.

MOLDS WANTED

BRUSH MOLDS & BRUSH MACHINERY, injection molds for ladies, men's, military, nail, toothbrushes, etc. Send particulars & samples. Box 382, REALSERVICE, 110 West 34th St., New York, N. Y.

TOY & NOVELTY MANUFACTURER will pay cash for obsolete or idle molds. Send samples, size and number of cavities to: TEE-VEE TOYS, INC., 55 Amory Street, Roxbury 19, Massachusetts.

PLANTS FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 1203, Modern Plastics.

HELP WANTED

POLYESTER RESINS AND LAMINATES
If you are capable of designing and managing production of a plant to produce Polyester Resins and Laminates, we have an interesting situation. Write fully, detailing experience.
Reply Box 1222, Modern Plastics.

CHEMIST—With experience in formulating and preparing molding compounds, especially Cold Molded materials. State experience, salary and availability. Reply Box 1223, Modern Plastics.

MOLD DESIGNER NEEDED—Large engineering company in midwest in need of designer familiar with the design of matched molds and half molds used in reinforced plastics. Include complete discussion of experience and salary requirements in first letter. Reply Box 1208, Modern Plastics.

TECHNICAL SALESMEN WANTED—Position open with large Midwest color manufacturer to head up color sales to the plastics and rubber industries. Must have some experience in the use of color in the plastics and rubber fields. Excellent opportunity for advancement in a new department. Reply Box 1204, Modern Plastics.

EXTRUSION ENGINEER. West coast extruder needs good practical man for custom extrusion work, pipe, film, etc. State experience, age, salary, etc. Reply Box 1212, Modern Plastics.

SALES MANAGER wanted by large plastic company located in Midwest. Now producing industrial parts for national accounts. Starting in molded Fiberglas and desiring to expand sales. Preference for man with successful industrial sales background. Submit complete resume, qualifications, experience, and references. Confidential. Reply Box 1211, Modern Plastics.

CHEMISTS AND CHEMICAL ENGINEERS FOR RESEARCH, PILOT PLANT, SALES SERVICE. Outstanding opportunities to grow with an expanding petro-chemical company well known for its progressive policies. Applicants should have background in polymerization and/or plastic applications. Experience with polyethylene preferred. Location: Mid-Illinois.
NATIONAL PETRO-CHEMICALS CORPORATION
120 Broadway, New York 5, N. Y.

WANTED: AMBITIOUS MAN with several years experience in Wire and Cable production in plastics and rubber. Must really know extrusion and cabling, with some of the chemistry and testing. A really unusual opportunity for the right man. Reply Box 1218, Modern Plastics.

PLASTICS ENGINEER trained or experienced in the production or selling of re-inforced plastics, particularly fiber glass laminates. Must be prepared to assume heavy responsibilities within sixty days. Location: Cleveland area. Reply Box 1225, Modern Plastics.

(*Continued on page 244*)

SHORT CUT
to
plastics information

A high proportion of your routine questions about plastics and plastics processing, plus lots of other questions which are genuine "puzzlers," can be answered by referring to your copy of the 1953 MODERN PLASTICS ENCYCLOPEDIA AND ENGINEER'S HANDBOOK.

Here, readily accessible, arranged for quick reference, you will find *basic* as well as *specialized* plastics information. It contains data on the chemical and physical properties of the different plastics resins . . . on processing film and sheeting . . . on decorating plastics . . . on laminating . . . on mold design for various types of molding . . . on machinery and equipment . . . on literally *thousands* of additional subjects.

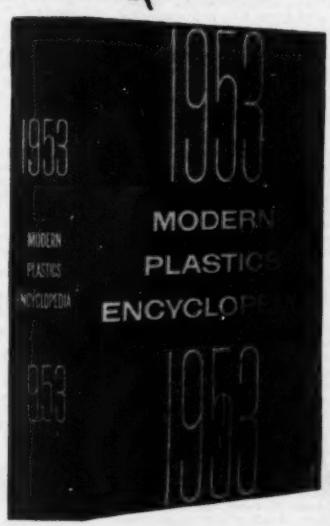
Get acquainted with the MODERN PLASTICS ENCYCLOPEDIA right away. Refer to the many fact-filled ads. Explore the extensive Directory Section which lists suppliers of materials, equipment and services. Use it often. Doing so will be to your advantage.

Published by

PLASTICS CATALOGUE CORPORATION
575 Madison Avenue
New York 22, N. Y.
An affiliate of Modern Plastics

ARE YOU CONFUSED BY TRADE NAMES?

The Plastics Industry is beset by a welter of trade names, many of them confusingly similar. The Directory of Trade Names, beginning on page 899, lists them alphabetically, describes the product, and gives the manufacturer.



CLASSIFIED ADVERTISING

(*Continued from page 242*)

POLYESTER RESIN CHEMIST: To aid in development of commercial line of resins for medium sized, well established chemical company upper New York State. Either full time or part time consulting basis will be considered. Submit complete resume, salary or fee required. Reply Box 1231, Modern Plastics.

SALES ENGINEERS to represent old-established injection molder. Press capacity 4 to 200 ounces. Tool room, painting, silk screening, hot stamping—all conveyorized. Straightline assembly. Automatic packaging equipment. Prefer experienced men and men with industrial contacts. Also men controlling one or more special deals. Large midwest plant. Give complete details. Personal interview to follow. Reply Box 1201, Modern Plastics.

MIDWESTERN Machinery Manufacturer desires services of Experienced Plastic Molding Machinery Development Engineer to head up expansion program in plastics field. Replies held in confidence. Send us pertinent personal data, experience and salary requirements. Reply Box 1215, Modern Plastics.

RESIN SALES. Could use one more good man. Full line Urea, Phenolic Resins—Liquid or Powder types. All correspondence treated in confidence. Address Reply to SALES MGR., c/o P.O. Box 1768, Wilmington, Delaware.

PLASTIC MOLD ENGINEER AND DESIGNER. Experience required in designing injection molds and estimating production and mold costs. Expanding business, new products, modern plant and techniques offer unusual future. Salary in line with experience and ability. Plant located in Metropolitan New York. State age, experience, etc. Reply Box 1206, Modern Plastics.

POLYESTER PRODUCTION MAN:—If you have experience in the fabrication of Polyester resins we can offer a partnership and/or a profit sharing arrangement in a new large scale operation without any investment by you. To qualify, a thorough know how of all phases of production with current experience in the actual fabrication and production of corrugated sheets, auto bodies, etc., is required. A technical background is preferred but not essential. We will also consider a technical service man who is engaged in development work in the manufacture and use of polyester resins. Write giving details which will be held in the strictest confidence to the JOHN BROKERAGE ASSOCIATES CO., Rooms 303-306, 400 38th Street, Union City, New Jersey.

GLASS FIBRE FORMING. Manager required for British Co. manufacturing Glass Fibre for special purposes. Top level situation, high salary rate, production bonuses for experienced man. GLASS FIBRE AND BUSHING TECHNICIANS also required. High salary rate, production bonuses and splendid opportunity for experienced men. All expenses will be paid to suitable applicants. Write in the first instance giving full particulars of past experience in the strictest confidence to the Managing Director. Reply Box 1229, Modern Plastics.

LOS ALAMOS REQUIRES a Graduate Engineer or Chemist for development application of plastics. Should be familiar with properties of plastics and rubber and with fabrication techniques including part and mold design. Write Attn: John A. Stevenson, LOS ALAMOS SCIENTIFIC LABORATORY of the University of California, Los Alamos, New Mexico.

WANTED: SALES ENGINEER or Technical Representative, wanted by well established custom molding plant, near Newark, for New York and suburban territory. Replies held in strictest confidence. Reply Box 1224, Modern Plastics.

PLASTIC SUPERINTENDENT. We want a top man experienced in all phases of Injection Molding—assume full charge of foreman, production, quality control etc. Supervise machine maintenance. Must be good organizer and leader and capable of getting the best results from his assistants. Unusual opportunity with large established Chicago Molder. Reply in confidence to Company President. Salary open plus profit sharing. Reply Box 1214, Modern Plastics.

POLYETHYLENE

Do you have experience in thermoplastics and want an opportunity in a young, growing organization?

Spencer Chemical Company will soon be producing polyethylene. Men are needed—now—in . . . TECHNICAL SALES . . . TECHNICAL SERVICE . . . PRODUCT DEVELOPMENT . . . APPLICATION RESEARCH.

If you are experienced in the processing or sale of thermoplastic resins, your inquiry will receive immediate consideration. A degree in Chemistry or Engineering is highly desirable.

Spencer Chemical Company offers liberal employee benefits—vacation, insurance, retirement. Of greater importance, you will be a charter member of the Spencer plastics team.

Please write to Mr. J. E. Culpepper, General Sales Manager, with a detailed description of your experience and a statement of your initial salary requirement. All inquiries will be held in strict confidence.

SPENCER CHEMICAL COMPANY
Dwight Building Kansas City, Mo.

SITUATIONS WANTED

COATING-LAMINATION-EXTRUSION-PRINTING-FOIL ROLLING-METAL EVAPORATION.
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At present technical director AAA-1 company
AVAILABLE FOR ONE OR TWO DAYS PER WEEK ON PERMANENT BASIS.
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WORKS MANAGER OR CHIEF ENGINEER. Plastics Engineer with thorough knowledge and experience in all phases Injection Molding, with emphasis on Technical Service, Product Design, Estimating, Mold Design, Molding and Assembly Department Supervision, Packaging, Quality Control and Incentive Systems. Presently Superintendent large Molding Plant. Desires responsible position with progressive organization. Would consider buyer's position with large scale user of Plastics. Reply Box 1213, Modern Plastics.

PLASTICS EXTRUSION ENGINEER. Production and development experience. Very familiar with the capabilities of extrusion equipment and with the quality control techniques essential to profitable production. Now in full charge of acetate sheet production unit, and rigid vinyl extrusion development. Seeks challenging opportunity to use wide experience. Will relocate. Reply Box 1219, Modern Plastics.

PLASTIC FOREMAN SUPERVISOR, technician, compression and Teflon molding. Many years experience. Thorough knowledge of all phases, from the raw material to the finish product. Diesetting for presses and preform machines, maintenance of equipment. Run shop and production line. A-1 ref. N.Y. area desired. Reply Box 1226, Modern Plastics.

SALES AGENTS WANTED

WANTED: FORMED PLASTIC SALES REPRESENTATIVE. We need high calibre sales engineers dealing at an engineering level for the following areas: Springfield, Mass.; Providence, R.I.; Hartford and Bridgeport, Conn.; New York. Men should preferably have a following in the field of injection molding or metal housings. Training provided at our expense at home plant. Remuneration—commission. Write, wire, or phone Sales Manager, GREGSTROM CORP., 14 Davis Street, Cambridge, Mass.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Midwest Custom Injection Molding Company requires representation in all midwest industrial areas on commission basis. Applicant assured of excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Reply Box 1209, Modern Plastics.

SALES REPRESENTATION WANTED by established manufacturer, for the sale of PLASTIC EMBEDMENTS. Complete line of embedded plastics for industrial display, premium advertising and gifts. We are interested ONLY, in men of proven ability. Protected territory in some eastern, midwestern and western states. Give full details and references. Reply Box 1205, Modern Plastics.

TEFLON—An established organization of representatives wanted for many of the major industrial areas to sell DuPont's Teflon and Dixon's Rulon plastics. Exclusive territory selling for established and growing Teflon processor. Write DIXON CORPORATION, Bristol, R. I.

REPRESENTATIVE WANTED. Plastic Manufacturer having small injection molding equipment and complete fabrication equipment wants representative calling on industrial accounts in St. Louis, Cleveland, Cincinnati, Louisville, Birmingham, Milwaukee, Detroit, Minneapolis areas. Reply Box 1210, Modern Plastics. Our Representative knows of this ad.

EXPERIENCED SALES REPRESENTATIVE wanted by custom molder for territories New England, Michigan and Illinois. Please send resume including salary requirements to B. Frank Hantz, Vice President in charge of Sales, AMERICAN INSULATOR CORPORATION, New Freedom, Pennsylvania.

MISCELLANEOUS

TOYS: We are toy representatives (commission salesmen), selling every major variety and drug chain. If you intend to keep your machines profitably busy manufacturing your own proprietary toys, we can help you. We know the chain buyers well and can guarantee immediate national distribution for toys of merit. Buying for 1954 starts in 30 days. Please reply immediately. TELL SELL CORP., 200 Fifth Ave., New York 10, N. Y.

WANTED: A COMPANY that extrudes different types of plastics. A corporation wishes to diversify manufacturing and provide an additional line for its fifteen sales offices and warehouses. Reply Box 1220, Modern Plastics.

FOR SALE: ACETATE, white, ivory, pink pastels, red, blue and green, at 28c per pound, F.O.B. New York, regular supply. Odd colors 23c.
16 OUNCE IMPCO Injection Machine, without press, $5000.00.
WANTED: a 350 ton Toggle Press.
PEERLESS CHEMICAL CORP.
181 Greene Street, N. Y. C. 12.

MEDIUM SIZE COMPANY wishes to manufacture vinyl and polyethylene extruders and 2 to 16 ounce injection molding machines. Will purchase designs outright or may manufacture on royalty basis. Reply Box 1202, Modern Plastics.

PATENTED PLASTIC HOUSEHOLD necessity, entirely new idea, big volume seller, thru chain stores and as premium, possibilities of being demonstrated on T.V. as premium, retails for around 25 cents, every home a yearly prospect, low mould cost, for sale or license. Send replies to E. M. KENNEDY, 1648 E. 77th St., Cleveland, Ohio.

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Closing date: 28th of the second preceding month, e.g., November 28th for January issue.

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Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

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and vacuum forming
from the small to the very large

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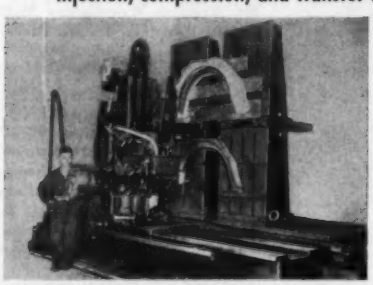

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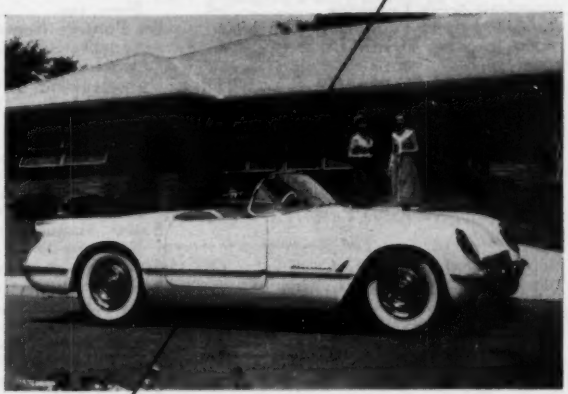

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When Chevrolet decided to mass produce the Corvette, their revolutionary new fiberglass-plastic sport car, they naturally wanted the most reliable and experienced molder in the field.

Therefore they chose the MOLDED FIBERGLASS COMPANY, whose continued skill and "know how" have made this organization the world's largest producer of Fiberglass reinforced plastics.

Kaiser also has chosen MOLDED FIBERGLASS to make Fiberglass molded parts for their new sport car.

Besides car bodies, this Company makes hundreds of different items, including furniture, loudspeakers, refrigerator parts, switch housings and lamp shades. Our products combine a high strength-weight ratio with resistance to corrosion, thermal and electrical insulation, and attractive appearance.

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Ashtabula, Ohio

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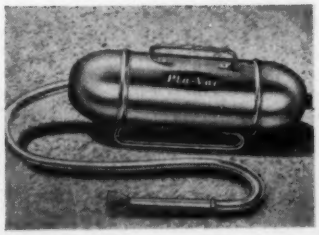

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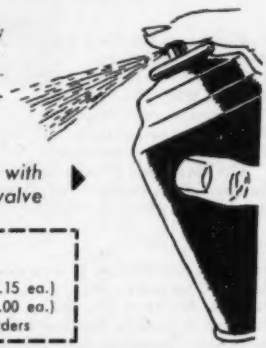

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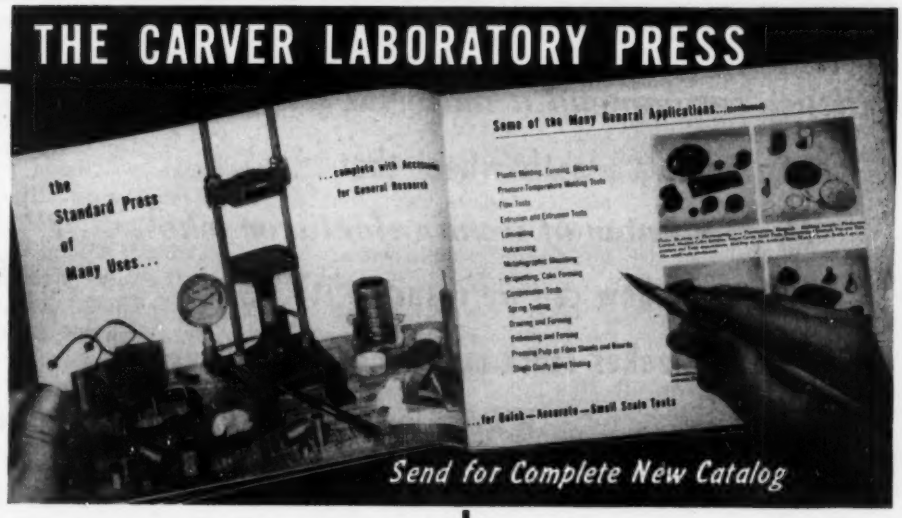
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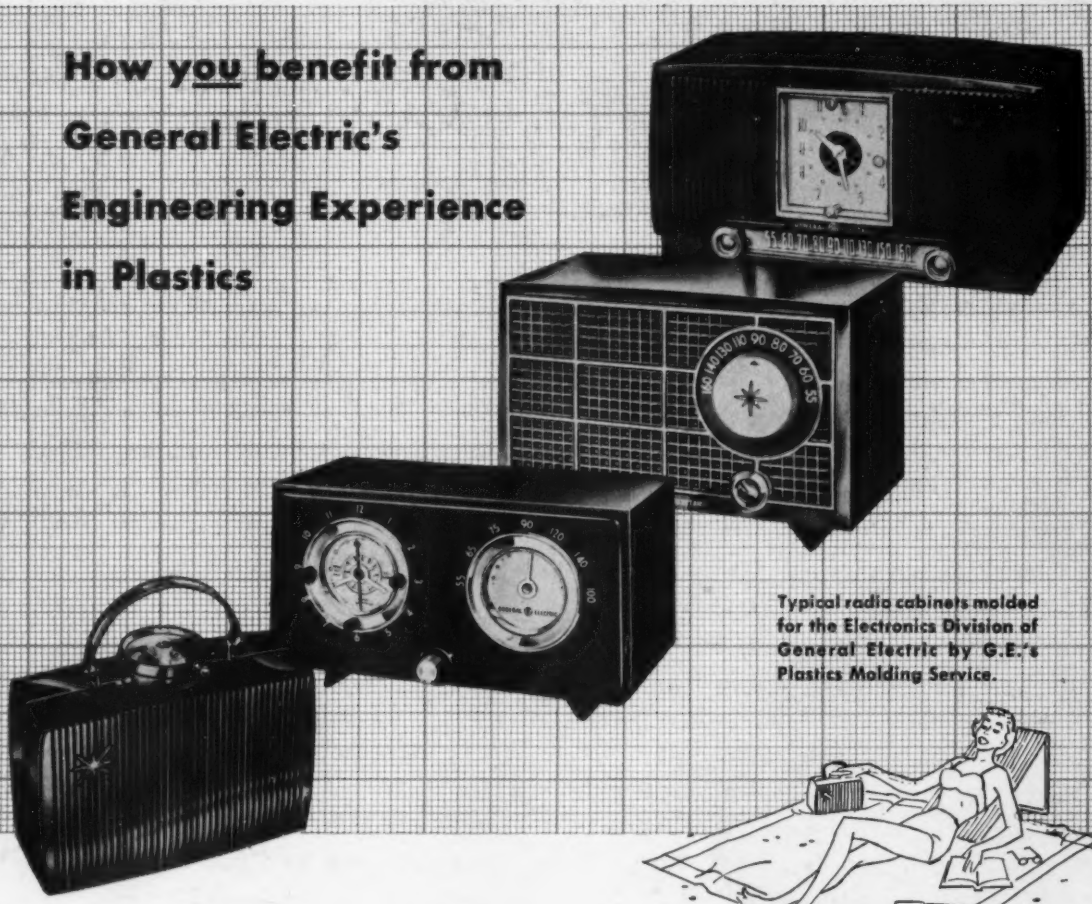

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